This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

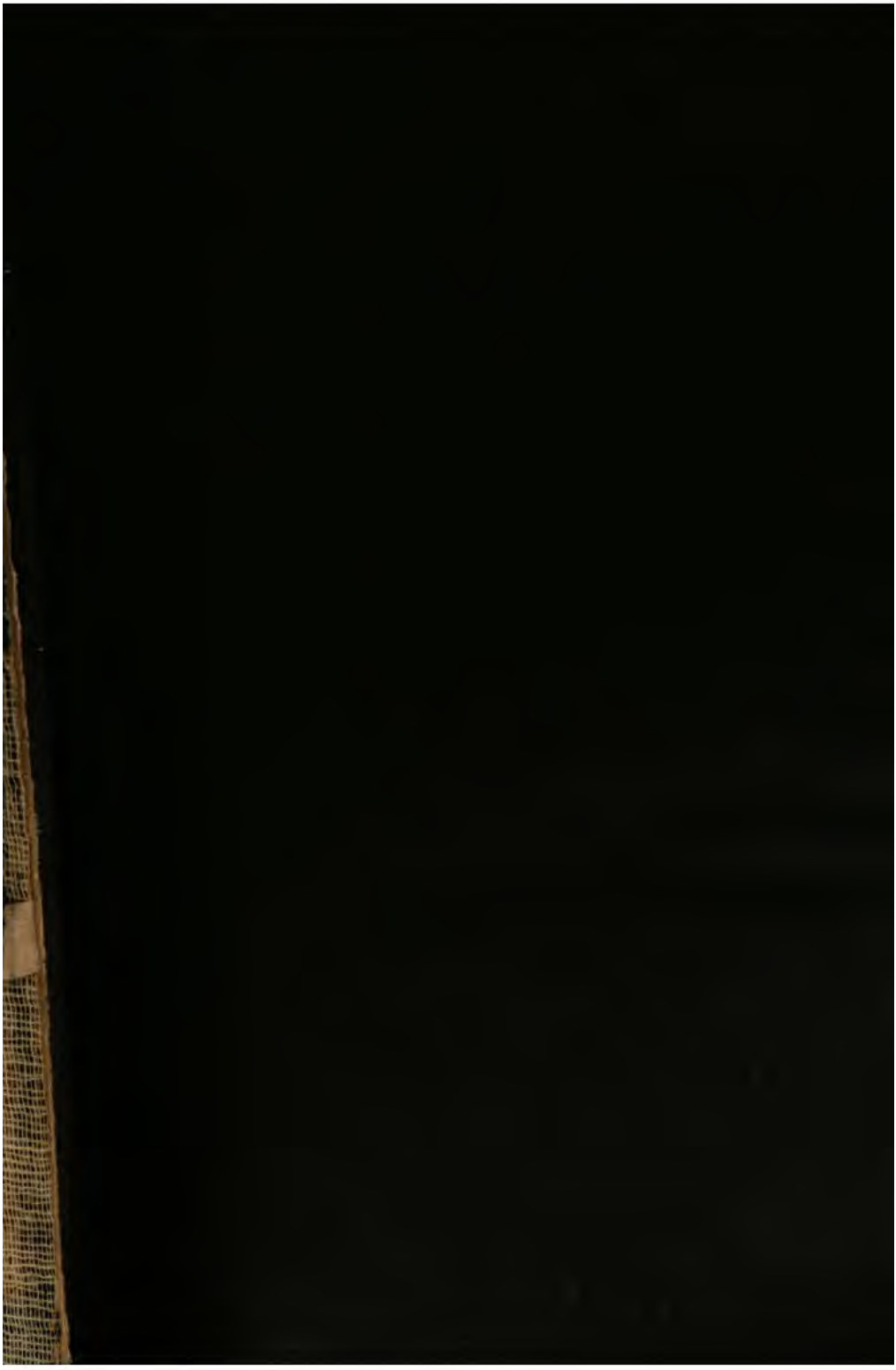
JP

Tdc
L89.3
v

HARVARD UNIVERSITY
ARNOLD ARBORETUM
PRESENTED BY
CHARLES SPRAGUE SARGENT
1872

DEPOSITED AT THE HARVARD FOREST
1943

RETURNED T
MARCH. 1



Tdc
L89.3
r

JP

DEPOSITED AT THE
HARVARD FOREST
1943

RETURNED T
MARCH, 1

Colonial and Indian Exhibition,

LONDON,—1886.

REPORTS

ON THE

COLONIAL SECTIONS OF THE EXHIBITION.

ISSUED UNDER THE SUPERVISION OF THE COUNCIL OF THE SOCIETY OF ARTS, AND

EDITED BY

H. TRUEMAN WOOD, M.A.,
SECRETARY TO THE SOCIETY.

LONDON:
WILLIAM CLOWES & SONS, LIMITED,
Printers and Publishers to the Royal Commission,
13, CHARING CROSS, S.W.
1887.

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
STAMFORD STREET AND CHARING CROSS.

INTRODUCTION.

IN the scheme for the Colonial and Indian Exhibition, which was approved by H.R.H. THE PRINCE OF WALES, there was included a provision for the preparation of Reports on the exhibits of the various Colonies; and in a communication, dated November 24, 1884, addressed to the representatives of the Colonies in this country, His Royal Highness announced his intention of inviting duly qualified persons to prepare Reports which might serve as a permanent record of the principal contents of the Colonial portion of the Exhibition.

In May, 1886, Sir Philip Cunliffe-Owen, the Secretary to the Royal Commission, addressed a letter to the Council of the Society of Arts, asking whether the Society would undertake to superintend the preparation and issue of a series of Reports on certain of the Colonial Sections of the Exhibition. After some correspondence as to the precise scope of the Reports, and the arrangements necessary for carrying out the proposal, the Council of the Society undertook the duty, and in a letter to Sir Philip Cunliffe-Owen, dated June 29, expressed the readiness of the Society to act.

It was decided that, having regard to the wide scope of the Exhibition, it would be desirable for the most part to confine the Reports to the consideration of the raw products exhibited, or of such manufactured products as would be likely to be of commercial importance in the trade between Great Britain and the Colonies. To this rule, however, it was necessary to make certain exceptions. The important exhibits of machinery made by several of the Colonies appeared to call for special notice,

and a Report on Machinery was therefore added. At the request of the High Commissioner for Canada, a Report on the Musical Instruments shown in the Exhibition was also included.

The Council, after carefully selecting the subjects which appeared most important, and classifying them in such a manner as to secure that no important industrial products should be wholly overlooked, submitted to H.R.H. THE PRINCE OF WALES a list of gentlemen whom they considered qualified to prepare the necessary Reports; and these gentlemen His Royal Highness was accordingly pleased to nominate.

The original proposal did not comprise Reports on the Indian products shown, but by the desire of the Royal Commission the Reporters on Tea, Coffee, and Tobacco were requested to include the Indian exhibits in their Reports; and in some few other cases the Reporters have dealt more or less fully with Indian products.

The Council have to express their thanks to the Reporters for the promptitude with which they undertook a very difficult task, and for the minute care and attention which they have, one and all, devoted to the subjects with which they have dealt.

The editorial work has been performed by the Secretary of the Society.

H. TRUEMAN WOOD,

Secretary to the Society of Arts.

CONTENTS.

PAGE

1. MINING INDUSTRIES. By C. Le Neve Foster 1
2. MINERALS AND GEMS. By J. Reynolds Gregory 55
3. MEAT AND DAIRY PRODUCTS. By Clare Sewell Read 86
4. GRAIN. By W. Proctor Baker 96
5. FRUITS. By D. Morris 129
6. TEA. By A. G. Stanton 147
7. COFFEE. By H. Pasteur 167
8. COCOA. By H. Pasteur 178
9. SUGAR. By Nevile Lubbock 184
10. WINES, SPIRITS, BEER, AND OTHER FERMENTED LIQUORS. By R. Bannister . 191
11. TOBACCO. By G. Watt and John McCarthy 233
12. DRUGS, CHEMICAL AND PHARMACEUTICAL PRODUCTS. By B. H. Paul . 248
13. OILS AND FATS. By Leopold Field 260
14. GUMS, RESINS, AND ANALOGOUS SUBSTANCES. By Thomas Bolas . . 283
15. COTTON. By J. Butterworth 299
16. WOOLS. By F. H. Bowman 304
17. SILK. By T. Wardle 330
18. MISCELLANEOUS FIBRES. By C. F. Cross 364
19. LEATHER, LEATHER GOODS, FURS, HIDES, AND TANNING MATERIALS. By J. Powell 391
20. TIMBER (No. I.). By T. Laslett 412
21. TIMBER (No. II.). By Allen Ransome 462
22. MACHINERY. By W. Anderson 476
23. MUSICAL INSTRUMENTS. By John Stainer 491

INDEX 493

Colonial and Indian Exhibition.

LONDON, 1886.

REPORTS ON THE COLONIAL SECTIONS.

MINING INDUSTRIES.

By C. Le Neve Foster, B.A., D.Sc. (London), B-ès-Sc. (Univ. France), A.R.S.M., F.G.S., one of Her Majesty's Inspectors of Mines.

It is with no slight sense of responsibility that I have undertaken to write a report upon Mining Industries as illustrated by the Ores, Coal, Building-stones, Mining Machinery, &c., displayed by the Colonies at the Colonial and Indian Exhibition. Our possessions are so vast and numerous, and their mineral resources so great and varied, that it is impossible to do justice to them in the few pages allotted to me. I have endeavoured, however, by mentioning the excellent handbooks and catalogues prepared specially for the Exhibition, and other recent books and official reports, to indicate sources of more detailed information, which are available, at very small cost, for those who desire to obtain a closer insight into the mineral wealth of any particular Colony.

I have taken the Colonies in the order given in the Official Catalogue, and in dealing with the products of each Colony I have thought it wise to adopt an alphabetical arrangement. It is true that this arrangement is not scientific and rarely gives the first place to the most important mineral, but, on the other hand, it is understood by every one, and it is the plan found most convenient by the British Inspectors of Mines in our Mineral Statistics. I may here mention that for the last three years our annual volume has contained a table showing the quantities and values of the minerals produced in the British Colonies and Possessions.

DOMINION OF CANADA.

The collection of Metallic Ores, Coal and other Minerals of economic value was very extensive. Its completeness was largely due to the contributions made by the Geological Survey of Canada, Mr. T. A. Keefer, and the Provincial Government of Nova Scotia, and its value was greatly enhanced by a descriptive catalogue, full of useful notes, which formed an excellent handbook upon the mineral wealth of the Dominion. In specifying the various provinces, I frequently copy the plan adopted in the Catalogue of

using the initial letter as an abbreviation. Thus O. signifies the province of Ontario, Q. the province of Quebec, &c.

Asbestos.—An industry which has sprung into existence within the last few years is quarrying asbestos. The mineral, which is chrysotile and not fibrous hornblende, occurs in small irregular veins of $\frac{1}{8}$ inch to 7 inches wide in serpentine, the fibres running almost at right angles to the walls of the veins. Judging by the lumps sent by the Asbestos Mining & Manufacturing Co. of Canada, the Anglo-Canadian Asbestos Co., and the Boston Asbestos Packing Co., the veins worked are usually 2 or 3 inches wide. The rock is got from open quarries, and the asbestos is easily separated by cobbing from the serpentine and so rendered fit for the market. Some of it fetches as much as £16 a ton. The crude mineral is sold to factories where it is crushed; the silky fibres thus produced are carded and then spun into yarn, and finally into rope from which valve and engine packing are made. Mill-board, sheeting, and other products manufactured from asbestos were also exhibited.

The principal quarries are in the townships of Thetford, Coleraine and Danville, in the Province of Quebec. The output for 1886 will probably be at least 2000 tons.

Coal.—Though Canada proper has no coal, Nature has given the Dominion a bountiful supply of mineral fuel, for the total area of its coal-bearing formations is estimated at 97,000 square miles, or about four-fifths of the area of the United Kingdom.

The Coal districts are :—

I. Nova Scotia and New Brunswick.
II. The North-West Territories.
III. British Columbia.

I. Nova Scotia is the great coal-producing province of the Dominion. The coal is bituminous and the measures are of true carboniferous age. There are three principal coal-fields—Cape Breton, Pictou County and Cumberland County, in all of which mining is vigorously prosecuted. The Cape Breton district was well represented by blocks of coal from Sydney, Lingan, Reserve, International and other collieries. The Sydney main seam, 5 feet 6 inches to 6 feet thick, is extensively worked, and the output of Sydney Mine in 1885 was 124,274 tons of coal. Lingan Mine, twelve miles from Sydney, has several seams; the main one is 8 feet 8 inches thick, and furnishes a coal with only 1·79 per cent. of ash, which is largely used for making gas.

The principal collieries in the Pictou district are the Albion Mines with an output of 129,195 tons, Intercolonial 109,139 tons, and Acadia 98,150 tons, Vale 96,135 tons, in 1885. Some of the seams are very thick, "one worked by the Albion mines showing 58 feet of good quality;" other seams of 18 feet thick are worked. Large samples illustrated the nature of the coal, which is fit for steam and domestic purposes; some of it will make good coke.

The Springhill Collieries are the largest mines in Cumberland County, or indeed in the whole Dominion of Canada, and as I had the pleasure of visiting them two years ago, I can testify from personal observation to their natural advantages. Two seams, respectively 11 and 13 feet thick, are being worked, and a second 11-foot seam, a 6-foot seam, and several smaller ones have been proved to pass through the property. There are no faults and

there is no fire-damp, the dip is very regular, and the seams are very free from partings of dirt. I find that the output increased from 232,451 tons in 1884, to 335,055 in 1885. The coal is of good quality; it can be used for making gas and furnishes a compact coke. The collieries are connected by a line five miles in length with the main Intercolonial railway, and are well situated for supplying the ports of Halifax or St. John, N.B. Various samples were shown from these collieries as well as from the Joggins Mines in the same county.

Very little coal-mining is done in New Brunswick; but a seam of good caking bituminous coal only 2 feet thick is worked in two places at a depth of 10 to 15 feet from the surface.

The specimens of Albertite from Albert County, N.B., are merely scientific curiosities at the present time, for the vein which supplied some 200,000 tons of this valuable mineral thinned out, and the workings were abandoned after a depth of 1500 feet had been reached.

II. The samples of coal from the North-West Territories were few in number, but it must be recollected that coal-mining is quite a new industry, only just brought into being by the construction of the Canadian Pacific Railway and its branches. However, the facts set forth by the Geological Survey prove that the coal-resources of this part of the Dominion are very great.

The coal is of Tertiary and Cretaceous age, and in proceeding from East to West all varieties are met with, from lignite to true bituminous coal and anthracite.

In the Souris River district, a hundred miles west of Winnipeg, lignite occurs in the Laramie beds, a formation connecting the Secondary and Tertiary ages.

Next we have the great bed of lignitic coal, more than 20 feet thick, on the North Saskatchewan River, 75 miles above Edmonton.

Thirdly, we come to the Bow and Belly River district, west of Medicine Hat. The Canadian Pacific Railway derives some of its supplies from Lethbridge Mine by means of a branch line from Medicine Hat, 107 miles in length. The seam, which is 5 feet 4 inches thick, produces a valuable fuel, intermediate between true coal and lignite.

Lastly, we notice the specimens of anthracite from Banff, where the Canadian Pacific Railway enters the Rocky Mountains. Works are in progress for raising anthracite from two seams, each 4 feet in thickness, which, like the Lethbridge coal, occur in measures of Cretaceous age.

III. Bituminous coal of Cretaceous age is being largely worked in Vancouver's Island. The four Wellington collieries, within three miles of Departure Bay, had an output in 1885 of 222,000 tons. The average thickness of the seam is 9 feet, and the large obelisk exhibited showed that it sometimes is as much as 10 feet 6 inches. The Nanaimo collieries, seventy miles north-west of Victoria and also close to the sea, come next in importance with an output in 1885 of 137,548 tons. The enormous block of steam coal, more than 6 feet thick and weighing 5 tons 6 cwt., impressed the visitor with the importance of one of the seams at these mines; but the amount of ash, 10·5 per cent., is a decided drawback. Though the Vancouver's Island coal is the only good coal on the Pacific coast, and is shipped in large quantities to San Francisco, it has not full command of the markets; it has to compete with New South Wales coal brought up to

California in vessels which pass on to British Columbia to be loaded with soft pine timber required in Australia.

Copper.—Considering the depressed state of the copper market it is not surprising that the display of copper ores should be meagre. Deposits of copper pyrites are still being worked at Ascot, in the province of Quebec, but many mines have succumbed, owing to the low price given for their produce.

A curious calcareous breccia containing bornite with chalcopyrite and copper-glance was sent from Acton Mine, Q.

The copper pyrites from Coxheath, Cape Breton, N.S., was much mixed with veinstuff, but as the mine is very conveniently situated for smelting purposes it may possibly have a successful future before it.

The most interesting specimens came from Michipicoten Island, where there is a bed 3 feet thick, containing 2½ per cent. of native copper; the upper part is a reddish-grey sandstone, the under part a bluish-grey amygdaloid. One of the stones was polished, and showed the native copper disseminated in grains through the mass. This ore-bed has not yet been mined with the same success as the deposits in rocks of the same age on the south side of Lake Superior.

A deposit of copper ore, said to be extremely rich, is now being worked near Sudbury Junction on the Canadian Pacific Railway, a station north of Georgian Bay.

Gold.—Gold occurs in four principal regions:—I. Nova Scotia. II. Chaudière District, in the Province of Quebec. III. Lake of the Woods and Thunder Bay District. IV. British Columbia.

I. A large area in Nova Scotia, estimated at no less than 7000 square miles, is auriferous. The precious metal is derived almost solely from small quartz veins, 4 to 15 inches wide, often running parallel to the bedding of the enclosing quartzite and slate, but breaking across from time to time, and so proving that the veins are not beds contemporaneous with the enclosing rocks. The gold is coarse and therefore easily caught.

A magnificent specimen of native gold in clean white quartz came from the Albion Company's "Blue Nose" Mine, near Halifax, where I have seen the rich vein underground; and the sample from the Dufferin Gold Mine, Salmon River, East Halifax, is also good. Mispickel and a little iron pyrites, galena and blende are often met with in the auriferous quartz.

The quantity of gold raised in Nova Scotia is increasing gradually every year, which indicates that quartz mining is proving remunerative. The gilt obelisk informed us that the total quantity of gold extracted from 1859 to 1885 inclusive has been 395,180 ounces; the output in 1885 was 22,203 ounces.

II. The oldest known gold-mining district is in the Province of Quebec; the principal workings are along the Chaudière River and its tributaries. The nuggets and samples of coarse and fine gold which were exhibited explained what products are obtained by washing. The recent discovery of "deep leads," or old river channels, carrying coarse gold, such as was shown from Slate Creek, Beauce County, Q., is sure to give a fresh impetus to mining in this district.

III. The auriferous quartz veins in the neighbourhood of the Lake of the Woods have only lately been discovered, but are very promising.

The Huronian Mine, some seventy or eighty miles north of Port Arthur, produces an ore consisting of quartz, iron pyrites, copper pyrites,

sylvanite, blende, and galena, which yields gold and silver in paying quantities. The Tip-top and Highland gold and silver mines are other workings in the Thunder Bay District which sent samples of quartz with auriferous and argentiferous copper and iron pyrites; whilst the Kam Kam mine supplied quartz with auriferous galena.

A troublesome auriferous mispickel is mined at Marmora, north of Lake Ontario, by the Canada Consolidated Gold Mining Company, Limited; and the exhibits explained how the ore is treated by roasting and subsequent chlorination. The crude arsenic obtained is resublimed and sold in the form of refined arsenic or lump arsenic.

IV. British Columbia differs from Nova Scotia, as most of its gold has been dug from alluvial deposits in the valleys of existing rivers, many of which have been very productive, especially in the Cariboo district, which has furnished most of the samples exhibited. In spite of the discovery of new placers the yield of gold from British Columbia is decreasing steadily; however, judging by the specimens of rusty quartz with visible gold from Burns Mountain, Cariboo, McCulloch Creek, Columbia River, and other places, payable auriferous veins exist. It may therefore be reasonably expected that, with the facilities afforded by the Canadian Pacific Railway, quartz mining will become remunerative and cause the output of gold from British Columbia to rise again once more. The total quantity produced from 1858 to 1885 was shown by a gilt obelisk to have been 49,342,558 ounces, but last year the output was only 670,783 ounces.

Gypsum.—This mineral is extensively quarried at Hillsborough in New Brunswick and also at several places in Nova Scotia, besides being mined along the banks of the Grand River in Ontario. Large blocks of gypsum were exhibited, as well as specimens of the anhydrite which accompanies it.

Iron.—There was an excellent show of fine blocks of magnetite; many came from mines in the Laurentian rocks, north of Lake Ontario. The deposits are very extensive and much of the ore is of superior quality, containing, according to the analyses, very little phosphorus. Some of the magnetite occurs in the form of veins and some in the form of highly-inclined beds intercolated among the metamorphic rocks. Owing to the want of fuel on the spot the ore is despatched by rail to Lake Ontario, and thence shipped to Cleveland, Ohio, or other iron-making localities in the United States.

Hæmatite is found in the same region; fine samples of this ore were also sent from Colchester County, and Pictou County, Nova Scotia, which in addition produce limonite and spathic iron. These ores are of special importance, as they occur close to coal and in a district where limestone for flux is readily obtainable. The Steel Company of Canada exhibited fine blocks of spathose iron ore and brown and red hæmatite from the Londonderry mines, Colchester County, together with ankerite and limestone used as fluxes, and also specimens of the Siemens iron made at its works from these ores.

Lead.—The output of lead ore in the Dominion at the present time is small. Good galena is produced by Victoria mine, Sault Ste. Marie, Ontario; by Enterprise Mine, Lake Superior, and in several other localities which were duly represented by specimens. Some is mined at Chats Island, Fitzroy, O., and the concentrated ore is sent to Kingston, O., to be smelted.

Mica.—Highly transparent mica from Villeneuve Mine, Ottawa County, Q., was shown by the British and Canadian Mica and Mining Company. Some of the plates were 6 inches by 9 inches, and larger ones up to 10 inches by 12 inches are said to be obtainable. The mica from North Burgess, O., was good, but did not equal the Villeneuve specimens in clearness. The use of the mica plates, some of which are only 2 inches by 3 inches, is rendered plain to Englishmen on examining Canadian stoves, which have numerous little windows made of the mineral.

Petroleum.—The oil-producing district of Canada is situated in Lambton County, Western Ontario. Mr. Waterman's exhibit was very complete, for in addition to the crude petroleum he showed the various products manufactured from it, viz., sixty different kinds of oil besides greases and paraffin wax.

Phosphate of Lime.—The production of apatite is becoming an important industry in the Dominion. The home of this mineral is in rocks belonging to the Laurentian series; sometimes it occurs in irregular veins in pyroxenite, and at others in the form of crystals, often of large size, in beds of limestone. The principal mines are in the townships of Templeton, Buckingham, Portland, and Wakefield in the county of Ottawa, Q., and many of them supplied samples. A huge block from Templeton Mine consisted mainly of the so-called "Sugar-Phosphate," a finely-granular apatite rock not unlike a dirty saccharine marble, but containing also lumps of the coarsely crystalline mineral. The specimen from Little Rapids Mine, Portland, Q., on the contrary, was nearly all the clean-looking coarsely crystalline variety. From Emerald Mine, Buckingham, Q., came large crystals imbedded in limestone, and a single crystal weighing 550 lbs. The prevailing colour is green, but red is not uncommon; in fact all shades of colour are met with. The workings are spoken of as mines, but the excavations are usually open to daylight; some of the pits are worked to a depth of more than 100 feet. The output in 1885 was 23,908 tons.

The shell marl sent from Prince Edward Island is mud dredged up from river-beds; it forms an excellent manure.

Plumbago.—Graphite occurs in beds and veins in the Laurentian rocks in the Provinces of Ontario, Quebec, and New Brunswick. Mr. Walker made a splendid display of plumbago from Buckingham Mine, Ottawa County, Quebec, one of his specimens weighing 4870 lbs. He showed also by samples of various goods that the plumbago is suitable for all the purposes to which the mineral is usually applied, such as the manufacture of pencils, crucibles, stove-polish, &c.

Salt.—Brine springs at Warwick and Seaforth, O., and at Sussex, N.B., are utilized for the manufacture of salt.

Silver.—An admirable collection made by Mr. T. A. Keefer illustrated the occurrence of silver ores in the Thunder Bay and Port Arthur district, Lake Superior.

First and foremost we had the native silver and silver-glance from Silver Islet Mine, interesting on account of its situation and wealth. Workings were started in 1869 on a mere rock, 25 yards in diameter, and standing only 8 feet above the level of the lake, at a distance of half-a-mile from the shore. The islet had to be enlarged artificially to make room for the machinery. The vein was rich in proximity to a diorite dyke and yielded $3,000,000 of silver; the mine was stopped in 1884, after having reached a depth of 1230 feet.

Several cases were well filled with specimens from mines in the new silver region, between Port Arthur and Whitefish Lake; two of the best known are Rabbit Mountain and Beaver.

In Rabbit Mountain Mine, twenty-five miles by road from Port Arthur, the ore is native silver and argentite associated with fluor and quartz. The vein is 12 to 15 inches wide, and traverses slate of the Animikie series (Lower Cambrian).

The vein at Beaver Mine is about 5 feet wide, and consists of quartz, sometimes amethystine, calcite and blende, with silver-glance and native silver. It was evident from specimens containing numerous fragments of slate enclosed in the veinstuff that the lodes are filled-up fissures.

The ores at Porcupine and Silver Mountain Mines occur in similar brecciated veins.

The stuff as it comes from the mines is hand-picked, yielding rich lumps ready for the smelter, and poor rock which must be stamped and concentrated by Frue vanners before it is fit for the market. Mr. Keefer's collection warrants the assertion that an important silver-mining district is being opened up.

Stone.—No Colony furnished such a large collection of building stones as the Dominion of Canada. There were upwards of a hundred and fifty dressed cubes, which gave an idea of the appearance of the stone when used for building, and many of the specimens of marble and granite were polished and showed the value of these materials for decorative purposes. It is impossible, within the limits of this report, to give more than a bare list of the varieties of stone exhibited. We had limestone and dolomite from many parts of the Dominion, and likewise several kinds of sandstone, among which, that from New Brunswick deserves special notice; handsome specimens of red granite came from Kingston, O., Forsyth's Island in the St. Lawrence, and also from Charlotte County, N.B.; good grey granite is quarried in New Brunswick and Nova Scotia. Marble of various tints and colours is abundant in the provinces of Quebec and Ontario, and serpentine crops out frequently on the south side of the St. Lawrence. The dark porphyry, with crystals of red felspar, from Granville and Chatham, Q., and the remarkable jasper conglomerate from the Bruce Mines, Lake Huron, O., are beautiful rocks, and I must not omit to mention also the labradorite from the province of Quebec and coast of Labrador.

The New Rockland Slate Co. displayed various products from its quarry at Melbourne, Q., viz., good roofing slate, with a smooth split and free from pyrites, and large black-boards and well-fitted wash-tubs made from slabs. The supply of excellent slate in the district south of Montreal is said to be unlimited.

In addition to the economic minerals already mentioned, the Dominion produces antimony ore, barytes, celestine, clays, chrome iron ore, infusorial earth, iron pyrites, magnesite, manganese ores, ochre, soapstone, umber, and zinc blende. Details concerning them will be found in the descriptive Catalogue.

To appreciate fully the labours of the Geological Survey, we must glance at its long series of published reports and maps, and we must recollect also that the members of the Canadian Corps have not such an easy task as their brethren in Europe, for they have frequently to combine the work of the explorer and topographer with that of the practical geologist. The reports are well-known, but all persons are not aware that

they are published in French as well as in English. The usual scale of the maps is 1 inch to 4 miles, and they are chromolithographed, and not coloured by hand like those of the British Geological Survey. Maps of special districts are also issued on a scale of 1 inch to 1 mile.

A large manuscript map of the whole of the Dominion, on a scale of 1 inch to 27½ miles, embodied the results of the geological explorations up to January, 1886, and another showed the places where economic minerals occur.

Nova Scotia and British Columbia have Government Mining Departments, and detailed returns of the minerals raised are published every year in the official reports of the Inspectors of Mines. For Canada proper, no such returns are available; however, the Geological Survey has at last awakened to the desirability of collecting information concerning the output of the mines and quarries, and before long we shall have proper official statistics. The sole blot upon the Geological Survey Department is that it has allowed so long a time to elapse before commencing this necessary work.

For the present, the only general mineral statistics of the whole Dominion, with which I am acquainted, are those kindly compiled every year by Mr. E. Gilpin, Government Inspector of Mines for Nova Scotia, for the tabular statement published in our British volume.

MINERALS PRODUCED IN THE DOMINION OF CANADA DURING THE YEAR 1884.

Kind of Mineral.	Quantity.	Value.
		£
Coal	1,876,643 tons	619,336
Copper (*metal*)	1,762 ,,	42,979
Gold	55,000 ozs.	225,706
Gypsum	185,851 tons	41,121
Iron Ore	88,955 ,,	40,133
Lead Ore	50 ,,	200
Manganese Ore	885 ,,	7,567
Miscellaneous minerals, viz., Asbestos, Iron pyrites, Mica, Slate, Stone, &c.	... ...	47,740
Petroleum	550,000 brls.	93,500
Phosphate of Lime	21,821 tons	92,664
Salt	145,000 brls.	22,800
Silver Ore	37 tons	2,584
Total Value	... ...	£1,235,730

The following is a list of recent publications consulted :—

Descriptive Catalogue of a collection of the Economic Minerals of Canada. By the Geological Corps, Alfred R. C. Selwyn, C.M.G., LL.D., F.R.S., &c., Director. London, 1886.

The Mineral Resources of Canada. Lecture by Dr. Selwyn to the Geologists' Association. Mining Journal, vol. lvi., 1886, p. 829.

The Coalfields of Canada. By Frank D. Adams, of the Geological Survey of Canada. Paper read before the British Association, September, 1886.

Report of the Department of Mines, Nova Scotia, for the year 1885. Halifax, N.S., 1886.

NEW SOUTH WALES.

The first impression upon entering the New South Wales Court was that we were in a land of coal, tin, and copper; and I cannot help thinking that the Department of Mines acted wisely in teaching the British public by bold and striking exhibits that the Colony depends far less upon gold, as the mainstay of her mines, than upon more homely, though often more profitable, minerals.

A cursory glance at the large map, which occupied a prominent position, revealed the existence of great mineral wealth. Gold-fields large and small are scattered about in the best known parts of the Colony; the area of coal-bearing rocks is extensive; tin-fields exist in the north, centre, and south of the Colony; on the west is the new Silverton district, named after one of the metals it produces; and various localities yield copper. Iron accompanies the Coal Measures, which contain also areas yielding oil-shale, and even gems are not wanting.

Though the Department of Mines very naturally sent a large proportion of the exhibits, numerous companies and individuals also gave useful co-operation, and thereby rendered the collection thoroughly representative and complete. I may mention especially the exhibits of Prof. Liversidge, F.R.S., and Sir Saul Samuel, K.C.M.G.

Antimony.—Splendid blocks of pure stibnite were sent by the Minister of Mines and Messrs. Young and Lark of Sydney from the Carangula Mines on the Macleay River, and illustrations were given of the various products obtained in smelting the ore. Auriferous stibnite occurs in lodes in the Armidale and Cudgegong districts, and various specimens of it were exhibited.

Coal.—New South Wales, like the part of the British Principality from which it takes its name, is a country rich in mineral fuel, and sends a finer collection of coal than any other Colony. By referring to the coloured map contained in "New South Wales: its progress and resources," it will be seen that the coal-producing rocks extend along the coast to the south of Newcastle for 200 miles, and spread out inland to the north-west for more than 100 miles. In addition there are other smaller coal districts to the north. "The approximate area of the carboniferous strata is estimated at 23,950 square miles."

The large geological sketch map of the Colony, on a scale of 1 inch to 8 miles, compiled from the original maps of the late Rev. W. B. Clarke, by Mr. C. S. Wilkinson, the Government Geologist, informed us that the coal occurs in rocks of Permian and Carboniferous age. The classification adopted is:—

Permian . . .	Upper Coal Measures.	
Upper Carboniferous .	Lower Coal Measures	Upper Marine Series.
Lower Carboniferous .		Lower Marine Series.

There are three principal coal-fields: the Northern, including the important Newcastle district; the Southern with the great Wollongong collieries; and the Western, or Lithgow Valley district.

We may now turn to the ten valuable vertical sections of the New

South Wales Coal Measures on a scale of 1 inch to 10 feet, made from actual measurements by Mr. John Mackenzie, the official Examiner of Coal-fields. These sections showed that numerous seams of 5, 6, or 7 feet thick are met with, whilst some reach 12 feet, and one even 23 feet 6 inches, but this includes several partings of dirt.

Mr. Mackenzie also supplied enlarged sections of the seams on a scale of ½ inch to a foot, and in these we had all the details of the structure of the seams together with the exact nature of the roof and floor, matters of extreme importance in the economy of working a colliery. Most of the seams are fairly free from dirt, as it appeared that in thicknesses of 7 to 9 feet of coal there are often only two or three thin bands of inferior coal or stone amounting in all to a few inches. The sections showed also how the seams are worked. Thus for instance in the Lithgow Valley a 9-foot seam is worked in two parts; the lower 5 feet 6 inches are taken away while making the original drivages, which cut out the pillars, and then the rest will be removed when the pillars are finally worked away.

The actual coal itself was brought before us by a series of huge blocks, and valuable details were furnished concerning some of the principal collieries.

Beginning with the Northern coal-field, Stockton Colliery, on the north side of Newcastle Harbour, sent blocks 3 feet thick of a brilliant bituminous coal. The Newcastle Coal Mining Company exhibited excellent clean coal cut from a seam worked at a depth of only 303 feet at the Glebe, about 2½ miles by rail from Newcastle Harbour. The account given will fill the heart of many a British colliery owner with envy: the coal seam is about 10 feet 6 inches in thickness, is very free from faults, lies very regular, has a rock floor and a hard shale roof, and has an average dip of 1 in 20 to 1 in 30. It is a free-burning bituminous coal, suitable for household, steam, smelting, gas, and blacksmith purposes, and has a specific gravity of 1·29. This is a very different picture from what we have in many British coal mines; for in addition to the constant danger from gas, the manager is often troubled by faults and changes of dip which disturb the regularity of the roads, by an unsafe roof, by a floor which "creeps," and by having to wind his produce from a considerable depth. The Burwood Colliery, four miles from Newcastle, also produces bituminous coal, which resembles in composition that obtained from Stockton, as will be seen by comparing the analyses:—

	Stockton Colliery.	Burwood Colliery.
Moisture	1·32	1·62
Volatile hydrocarbons, &c.	36·80	35·58
Fixed carbon	58·72	57·90
Ash	3·16	4·90
	100·00	100·00
Specific gravity	1·265	1·29
Coke	61·88%	62·80%
Sulphur	Trace	0·14%

I may conclude this notice of the Northern coal-field by referring to the blocks of clean, solid, splint coal from Greta Colliery on the Great Northern Railway, 32 miles from Newcastle Harbour. The coal seam

varies from 17 feet 6 inches to 26 feet in thickness, and is reached by a shaft 450 feet in depth; it has a strong roof and floor and dips at the rate of about 1 in 6. The coal is of excellent quality, and is suitable for gas, household, steam, and other purposes; it bears shipment and carriage well.

In the Southern coal-field also the natural advantages are very great, as the coal can be mined in close proximity to harbours and sometimes by driving adits into the hill-sides. This is the case, for instance, at the Osborne-Wallsend Colliery. The seam averages 7 feet 6 inches in thickness of clean coal, without any bands of dirt in it; it has an excellent roof and floor and dips about 1 in 30. It is a semi-bituminous coal, suitable for steam, household, smelting, coking, and blacksmith purposes, and has a specific gravity of 1·35. It is the uppermost coal seam in the Wollongong district, and crops out at a height of 600 feet above the sea in the high ranges fronting Wollongong Harbour; it is worked by adit-levels, and an incline and locomotive-engine tramway of about 2½ miles in length serve to convey the coal from the mine to the harbour of Wollongong.

The Mount Kembla Coal and Oil Company, Limited, exhibited a clean hard coal, free from dirt and pyrites, from its 7-foot seam. The colliery is situated on the slopes of Mount Kembla, seven miles from Wollongong and fifty miles from Sydney. The mine contains five seams of coal and one of oil-shale, and it is connected with the company's shipping jetty at Port Kembla, about three miles south of Wollongong, by a private railway upon the Government gauge 7½ miles long. The coal is hard and bears transport well, and is certified to be an excellent steam, gas, and coking coal, and to be suitable for smelting, manufacturing and household purposes. It contains 8 per cent. of ash and 0·35 per cent. of sulphur.

The Mount Pleasant Coal Mining Company sent semi-bituminous coal from its colliery situated about three miles from Wollongong Harbour. The seam is about 7 feet 6 inches in thickness of clean coal without any bands of shale; it has an excellent rock roof and floor, and dips about 1 in 30.

From the Bulli Colliery, a little north of Wollongong, we had semi-bituminous coal from a similar seam 8 feet thick, without any partings of dirt, with an excellent rock roof and floor, and dipping 1 in 30.

I come lastly to the Western coal-field, about 90 miles by rail from Sydney. The geological map, on a scale of 2 inches to 1 mile, made by Mr. Wilkinson in 1875, affords useful information concerning this district, especially as it is accompanied by sections and marginal notes. The Coal Measures are shown to be reposing directly upon the granite, and their dip is only 2° to 5°.

The Lithgow Vale Colliery is working the lowest seam 10 feet 6 inches thick, which lies very regularly and is free from faults. The seam produces a useful compact splint coal, which bears carriage well, but has the disadvantage of containing from 9 to 12 per cent. of ash. Various other collieries are dependent upon the same seam.

I have thought it advisable to embody in this report many of the details which were furnished concerning the New South Wales collieries, because it is specially necessary with a low-priced mineral like coal to take into consideration all the conditions upon which economical working depends. Mere blocks of coal, however good, do not necessarily represent valuable properties; but when we learn that they come from thick seams,

free from faults, provided with good roof and floor, giving off little or no fire-damp, dipping with regularity, lying at shallow depths or even workable from adits, and situated close to railways and harbours, we then begin to realise the immense resources of the Colony as a coal-producing country. We are not surprised that the output is increasing rapidly, and that the coal finds its way to the other Australian Colonies, to the Pacific Coast from Chili to California, to China and to Japan. It needs no prophet to predict a brilliant future for the New South Wales collieries.

Copper.—By referring to the mineral map, it will be seen that there is a large district in the centre of the Colony which produces copper, and within this area copper lodes are being worked at Cobar, Nymagee and Mount Hope. The most striking exhibit was the trophy of ingots of copper from the Great Cobar Copper Mine, surrounded by splendid blocks of the ores from which the metal is produced, viz., rich cuprite, malachite, redruthite and chalcopyrite. Chessylite and native copper also occur there. "The quantity of ore raised during the year 1885 was 23,300 tons, which produced when smelted 2135 tons of copper, valued at £106,750."

Nymagee and Mount Hope sent similar oxidised ores, no doubt from shallow depths, together with the sulphides; whilst specimens from several other districts proved that cupriferous deposits are widely distributed over the Colony. The exhibits fully bore out the statement that New South Wales is rich in copper.

Gems.—Diamonds are obtained from Tertiary gravels and recent drifts in the north near Bingera and Inverell, and also along the Cudgegong River 160 miles north-west of Sydney, and a few have been found in other districts. The principal diggings are at Bingera.

Gold.—A good series of specimens sent by the Department of Mines deserved to be studied with care. It contained examples of the mode of occurrence of gold in the principal mining districts. The large blocks of auriferous quartz with pyrites and zinc blende, and in some cases calcite, from various mines at Adelong showed that the veins retain their strength and gold-bearing properties at the greatest depths hitherto reached in the Colony, the deepest mine having been sunk only 1030 feet. From Timbarra in the north we had an auriferous granite with one ounce of gold to the ton. New Reform Gold Mine, Lucknow, supplied specimens illustrating the association of free gold with calcite and mispickel, whilst from Golden Crown Reef, Lunatic, came auriferous metallic arsenic. The extraordinarily rich lump of gold in quartz from Mother Shipton Reef, Temora district, naturally attracted attention, and Mr. Watson's specimen from Major's Creek, of auriferous iron pyrites in cubes some 2 inches on the side, sufficed to refute the opinion, which is held in some countries, that such large crystals are not gold-bearing.

In addition to auriferous stibnite, which is shipped to England, Mr. Oppenheimer exhibited an ore consisting of quartz, calcite and a little stibnite, which contains as much as 3 to 6½ ounces of gold per ton, from Razorback Mine, 146 miles north-west of Sydney. As the presence of antimony interferes with the amalgamation of the gold, this ore is sent to Freiberg in Saxony to be smelted.

Twenty-five samples of alluvial gold were rendered more interesting by being accompanied by reports of their assays. Their fineness in gold varies from 982·5 to 809·5 per 1000.

Iron.—The marginal notes on the geological map of the districts of Hartley, Bowenfels, Wallerawang and Rydal, about eighty miles west of Sydney, explained the nature of the so-called "clay bands," which occur interstratified with the coal measures. They are beds of earthy brown hæmatite, some of which will yield 50 per cent. of metallic iron. In the same neighbourhood, magnetite associated with garnet rock forms large irregular masses in the Devonian strata.

The only works in the Colony where iron ore is being smelted at the present time are at Eskbank in this district. Favourable conditions for the manufacture of iron exist in other places, for thick seams of coal and abundance of iron ore occur, for instance, at Carlo's Gap on the railway 136 miles north-west of Sydney; and at Mittagong, about 60 miles south-west of the capital, we again find brown hæmatite in close proximity to coal.

Oil-shale.—Seams of oil-shale, otherwise known as Boghead mineral, torbanite, cannel coal or petroleum-shale, have been found in the coal measures in several parts of the Colony; but at present the mineral is being mined at only two places. The Australian Kerosene Oil and Mineral Company works a seam at Joadja Creek near Berrima, on the Great Southern Railway, 93 miles from Sydney, and showed a number of blocks about 1 foot thick. The following is the analysis of the mineral:—

Hygroscopic moisture	0·44
Volatile hydro-carbon	83·87
Fixed carbon	8·03
Ash (grey)	7·07
Sulphur	·58
	99·99

One ton of 20 cwts. produces 17,276 cubic feet of gas at 60° Fahr. and 30 inches barometer, and the illuminating power of the gas is 46 standard candles.

The splendid block of Boghead mineral sent by the New South Wales Shale and Oil Company came from their mine at Hartley, about 80 miles west of Sydney. According to Mr. Wilkinson's description on the geological map of the district, the seam is about 3 feet 2 inches thick, and yields up to 80 gallons of refined oil per ton.

Illuminating oil and paraffin wax are made from the shale at works in Sydney, and some of it is exported for use at gas works.

Quicksilver. — Cinnabar has been obtained from Tertiary drift at Cudgegong, and specimens of the cinnabar sand washed out were interesting, though the deposit is no longer worked.

Silver and Lead.—Previous to 1884 the principal silver mines in New South Wales were at Boorook, in the New England district, on the northern frontier of the Colony. The specimens showed that the ores worked were argentiferous iron pyrites and blende associated with quartz, and ferruginous "gossans," containing chloride of silver, which formed the upper parts of the veins.

Recent discoveries have revealed more valuable silver veins at Emmaville, Mitchell and Silverton, and their importance was made manifest, not

only by huge blocks of "gossan," and undecomposed vein material, but also by ingots of metal to the value of £3000.

Emmaville is in the Vegetable Creek district, within 25 miles of the boundary with Queensland. The ore consists of fahlerz with galena, blende and mispickel, and sometimes yields as much as 500 ounces of silver to the ton. Argentiferous ochreous gossans are also worked.

Mitchell near Bathurst supplied samples which spoke well for its prospects. The ores exhibited were mainly "gossans," that is to say, the portions of mineral veins near the surface, which have been decomposed and altered by atmospheric agencies. They consist mainly of brown hæmatite and quartz in various proportions; sometimes we have an ochreous cavernous quartz, sometimes a porous brown hæmatite with a little quartz, and the brown hæmatite often assumes botryoidal, mamillated, or stalactitic forms. Occasionally a little malachite, chessylite and cerussite are sprinkled through the mass, and no doubt the silver exists in the form of chloride. At a depth of about 100 feet undecomposed sulphides make their appearance, and from a depth of 150 feet we have an ore consisting of quartz with iron pyrites, copper pyrites, and a little galena. The huge cubes hewn out of the "back" of the Sunny Corner lode were some of the finest specimens of gossan I ever saw, and would be looked upon by most miners as a certain indication of riches. I regret that no assays of these Mitchell gossans were supplied; but proof of their value was afforded by the ingots of silver from Sunny Corner mines, and by the fact that 24,547 tons of ore from those mines smelted at Bathurst in 1885 produced 634,016 ounces of silver, and 6413 ounces of gold.

We now come to the famous Silverton or Barrier Ranges district, on the western border of the Colony, where 10,000 square miles are said to be argentiferous.

The Barrier Ranges Silver Mining Association sent a full series of specimens from depths of 40 to 130 feet. They were gossans, consisting of quartz and brown oxide of iron, with the carbonates of lead and copper and chloride of silver; the yield of silver varies from 100 to more than 2000 ounces per ton. The cavernous "burnt-up-looking" gossan from Apollyon Mine would be passed over by some persons as valueless, and yet it assays 2286 ounces of silver to the ton, affording an instance of the necessity of frequent assays, especially in new countries.

The collection of the Umberumberka Silver Lead Mining Company was also made with great care, and exhibited the peculiarities of an important vein. Ferruginous gossans containing oxidised ores of lead and chloride of silver occur near the surface, and give way in depth to spathic iron and galena, with stephanite, polybasite and native silver. It is interesting to note the association of these rich silver ores with spathic iron, as is often the case in Europe. Work was commenced in November, 1882, and 1176 tons of ore worth £25 a ton have been despatched to England, but now the ore is smelted on the spot.

I cannot fail to notice also the dark brown hæmatite and the ferruginous carbonate of lead rich in chloride and iodide of silver from the mines of the Broken Hill Proprietary Company, the large lumps of chlorobromide of silver from the Treasure Mine, and the chunks of solid argentiferous galena from Gipsy Girl, Homeward Bound, Bonanza and Comstock Mines, all in the new Barrier Ranges district.

The resources of this region must not be estimated simply by the fact that silver and silver-lead ore to the value of £108,281 were exported from it in 1885; but we should bear in mind that the Umberumberka Mine, for instance, is 340 miles distant from the sea-board, with 200 miles of road and 140 miles of rail carriage; in other words, the ore and all mining stores have to be carted a distance equal to that which separates London from Liverpool. As soon as the Silverton district is provided with better means of communication, we may expect not only a great increase in the output of silver and lead, but also the development of mines producing other metals.

Stone.—The collection, though not large, showed that excellent stones are available for architectural and decorative purposes.

A good sandstone is quarried at Pyrmont near Sydney, and many of the public buildings are constructed with it. Judging by the photograph of Mr. Saunders' quarry, large blocks can be got without difficulty.

For internal decoration I may notice the two large slabs of marble from Marulan, one mottled dark-black and grey, the other white and yellow; the white marble from Cow Flat, and the handsome warm, red encrinite marble from the neighbourhood of Tamworth. The polished adularia granite from Montague Island is attractive from the play of colours shown by the pearly crystals of felspar.

Gundagai supplies sandstone flags for pavements, and also roofing slates, though none of the latter were exhibited.

Tin.—The value of the tin is greater than that of any other metal produced in the Colony. Much is obtained from the Vegetable Creek tin-field, New England, and the geology of this district, on the northern boundary of the Colony, was explained by a geological map on a scale of $1\frac{3}{8}$ inch to one mile, by Mr. T. W. Edgeworth David, published last year. The most important feature in this tin-field is that, in addition to the recent alluvial tin-beds, there are "deep leads," *i.e.* stanniferous gravels of Eocene times which have been preserved from subsequent denudation by streams of basaltic lava. These deposits have to be worked like true mines by shafts and levels. The average yield of the old alluvia has been about 30 lbs. of clean tin ore to the cubic yard.

A very large portion of the Vegetable Creek district is occupied by granite, of which Mr. David distinguishes two kinds: one metamorphic, representing the extreme stage of alteration of the Upper Silurian rocks, the other intrusive. No metalliferous deposits have been found in the former, whilst the latter, which is of Permian age, encloses lodes of tinstone accompanied by many of its characteristic associates, such as wolfram, iron pyrites and arsenical pyrites, and occasionally native bismuth and molybdenite. We learn from the useful marginal notes that the total quantity of tin ore raised in the Vegetable Creek district from the first workings in 1872 up to the end of 1884 has been, as far as can be ascertained, 32,947 tons, valued at £1,551,520.

With very few exceptions, the specimens of tin ore came from New England. Rich blocks of lode-tin were sent from Red Cross, Dolcoath and various other mines, which were certainly very promising; one specimen was full of topazes. There was a good general collection of alluvial tin, varying in size from pebbles as big as a goose's egg to fine sand; lumps of stanniferous "cement" were simply tin gravel with its constituents united together, and so forming a conglomerate; some of it is so hard that it

must be stamped. The specimen of stanniferous cement from Curbis Block, Vegetable Creek, was so compact that it would evidently be crushed with more difficulty than much of the stuff derived from lodes.

The trophy made up of 4 tons of refined tin in ingots, bar and grain, appealed to the popular mind, and proclaimed to the world the wealth of the Colony in a valuable metal.

In addition to its very complete collection of minerals, the Department of Mines sent a valuable series of its publications, including its Annual Reports, numerous geological and mining maps, and the sections of the coal measures. I have already referred to some of them. The large mineral map showed where borings have been undertaken for water, coal and metalliferous alluvial gravels, and also for prospecting in mines themselves.

The long list of official Reports and numerous papers in Scientific Journals, written by Prof. Liversidge; occupies no less than three pages in the Catalogue, and the Colony may well be congratulated upon having secured the services of such an indefatigable observer of Nature.

Prof. Liversidge's papers and the Annual Reports of the Department of Mines contain full accounts of the mineral wealth of New South Wales, and I am much indebted to notes contained in the Official Catalogue. The little pamphlet, "New South Wales, its Progress and Resources," published in Sydney this year, is valuable, not only for its concise descriptions, but also for its coloured mineral map.

The output of the mines and smelting works in New South Wales in 1885 is shown by the following table :—

Mineral or Metal.	Quantity.	Value.
		£
Antimony	293 tons	4,296
Asbestos	6 ,,	90
Bismuth	14 ,,	3,700
Coal (Exports, 1,756,356 tons. Home consumption, 1,122,507 tons)	2,878,863 ,,	1,340,213
Copper (*metal*)	5,746 ,,	264,920
Diamonds, weight and value not stated	—	—
Gold	103,736 ozs.	378,665
Iron (bars, rails, and castings)	4,176 tons	25,793
Miscellaneous minerals	457 ,,	7,820
Oil-shale	27,462 ,,	67,239
Silver	794,174 ozs.	159,187
Silver-lead ore	2,286 tons	107,626
Tin (*metal*)	4,658 ,,	390,458
Tin ore	535 ,,	25,168
Total Value	... ...	£2,775,175

VICTORIA.

It was a happy idea to make the archway at the main entrance of the Victorian Court represent the total amount of gold raised in the Colony up to the end of 1885; for though the British public are well aware that

Australia is a great gold-yielding continent, many people do not know which division has, up to the present time, exceeded all others in productiveness of the precious metal; nor do the figures £216,000,000 convey so accurate a conception of this vast sum as an archway, apparently built up of gold bricks, each weighing 1000 ozs.

The Victorian Government sent a geological collection, a mineral collection and an economic collection. It is my province to deal specially with the latter, and at the same time to refer to numerous valuable contributions by private exhibitors.

Antimony.—Good stibnite was exhibited from Costerfield, accompanied by regulus and antimony made from it. Like some of the stibnite in New South Wales and New Zealand, it is auriferous, and has been worked for the gold it contains, "the antimony having been saved as a by-product." No antimony ore was raised in Victoria in 1885.

Clay.—The fine collection made by Mr. J. Cosmo Newbery, C.M.G., Director of the Technological Museum, at Melbourne, included pottery-clay, pipe-clay, china-clay, quartz and felspar, together with manufactured articles, and proved that the Colony can supply itself, if necessary, with pottery and porcelain. Some terra-cotta plaques, of very fine texture, showed that the most delicate ornamentation can be faithfully reproduced.

Coal.—Seams of coal are found in the Mesozoic rocks, and one which is 2 feet 6 inches thick has been worked at Moe, about 75 miles S.S.E. of Melbourne. A large block from this seam was sent by the Moe Coal Company, and a larger one was supplied by Mr. Scarlett from a seam 5 feet 8 inches thick, at Mirboo, a little to the south of Moe. No analyses were given. The coal has a dull fracture, and looks somewhat friable, but nevertheless, these or other yet undiscovered seams may partially supply one of the wants of the Colony. However, as far as the coast is concerned, its necessities can be met by coal from New South Wales.

Lignite has been worked to some extent at Lal Lal, near Ballarat.

Copper.—The lumps of copper pyrites, mixed with iron and arsenical pyrites exhibited from Bethanga, were far richer than the average stuff raised at the mines, which is said to contain only 1 to 2 per cent. of copper and 1 oz. per ton of gold. This ore is now roasted in heaps and smelted into regulus, containing 8 to 12 ozs. of gold per ton, which is sent to Germany for treatment.

Gold.—According to the label of a specimen exhibited by the finder, the first gold was discovered in Victoria by Mr. William Campbell, in 1849. It is a small lump of iron-stained quartz, not bigger than a hen's egg, showing one speck of gold in a small cavity about $\frac{1}{16}$ inch across, left, I fancy, by the decomposition of iron pyrites. The same exhibitor showed gold in quartz, from Campbell's Creek, found early in 1851. This is a good specimen of ferruginous quartz with bright native gold, bigger than a pea. Though these two specimens were altogether thrown in the shade by magnificent examples of crystallized native gold in quartz, under the same glass case, they were nevertheless of some historic interest. At the same time, I must not omit to mention one of the exhibits in the New South Wales Court, a water-worn lump of quartz containing veins of gold, some of which seem to have projected originally, and to have been beaten over the quartz by attrition. It was stated, that this was the first nugget found in Australia, having been discovered at Ballarat by Mr. Hargraves, in March 1851, and that it was exhibited at the Great Exhibition in London

the same year. Those who have read what Prof. Liversidge says in his paper on "The Minerals of New South Wales," will be aware that long before 1851 gold was known to exist in Australia, though the fact was not publicly recognised till that year.

It is scarcely necessary to say that the gold now being produced by the Colony is obtained both from veins or reefs and alluvia.

The mining districts are Ballarat, Beechworth, Sandhurst, Maryborough, Castlemaine, Ararat and Gippsland. The Ballarat and Sandhurst districts produce more than half the entire output of the Colony; but whilst the former still derives as much as three-fifths of its gold from alluvial deposits, the latter is mainly dependent upon quartz reefs.

The gold veins or "reefs" in Victoria are found in the Upper and the Lower Silurian rocks. The Government collection, prepared by Mr. C. W. Langtree, the Secretary for Mines, showed especially how the gold in the veins is associated with iron pyrites, and how a cellular honeycombed quartz is left by its decomposition and removal, whilst the gold is then unmasked and rendered visible in the little rusty cavities. Other samples illustrated the association of gold in quartz, with iron pyrites, galena and blende, and the grey laminations which are so frequently an indication of the presence of the precious metal.

Mr. Nicholas' collection exemplified the same facts; but more interesting still were the specimens and the drawing, which explained the so-called "indicators," at Ballarat. These are narrow beds, parallel to the planes of stratification of the enclosing slate, which are full of small cubical crystals of iron pyrites; the indicator exhibited was about ½ inch wide. Their dip is nearly vertical, and they can be traced for miles. The importance of these indicators is due to their enriching influences upon quartz veins which cut across them, rich gold occurring along the line of intersection. The copy of Mr. Charles King's drawing showed the intersection of the main indicator with the quartz vein worked at the Queen Company's mine, Ballarat East. The indicator is slightly faulted by the vein, and both vein and indicator are shifted 12 feet by a "slide" of later date.

Mr. King's notes say:—"About ten of these 'indicators' are known within a width East and West of 1400 feet, and in the case of six out of these, the quartz crossing them contains, at the line of intersection, exceedingly rich patches of gold, frequently in nuggets many ounces in weight." A more marked influence of the adjoining "country" upon the productiveness of a lode could not well be brought forward, and it recalls the well-known "fahlbands" of Kongsberg; but why only six out of the ten indicators should have the enriching effect is not stated, nor do we learn whether they differ from each other. No analyses of the indicators are given, and we are left in doubt, whether they are auriferous and furnished the gold to the vein, or whether they acted by supplying a precipitant which caused a deposition of gold from solutions filling the vein-fissure. Whatever may be the explanation, the facts observed at Ballarat East, and illustrated by the exhibits, are extremely interesting to the geologist, and of great commercial importance to the miner.

One of the most successful quartz mines in Australia, the Long Tunnel Gold Mining Company, of Walhalla, North Gippsland, sent a gilt trophy representing all the gold produced from the mine from the first crushing in November, 1868, to the 7th October, 1885, viz.: 423,408½ ounces of *standard* gold, said to be equal to 15 tons 11 cwt. 0 qrs. 4 lbs. I must here

point out that it is not usual in England in speaking of gold to use any other unit than the troy ounce, and the reduction of troy ounces into an unrecognised kind of ton simply introduces another element of confusion into our absurdly-complicated system of weights and measures.

Two large models showed how the mine is worked. At the end of a tunnel 563 feet in length, a shaft is sunk perpendicularly to a depth of 928 feet, and the inclined vein is reached by a series of crosscuts; both the pumping and winding engines, placed in the tunnel at the top of the shaft, are driven by compressed air.

Statistics furnished by the Company told of the great success which has resulted from its operations. Started in July, 1865, with a capital of £12,000, it began crushing in November, 1868, and since that time 283,592 tons of quartz have been stamped producing 452,794 ounces of 20-carat gold, or 1 oz. 11 dwts. 22 grs. per ton. The total value of the gold is £1,596,645, and 60 per cent. of this, or £964,800, has been paid in dividends to the lucky shareholders.

A full series of samples in boxes explained the process by which the gold is extracted. The stamped ore passes over amalgamated silvered copper plates and mercurial wells; the escaping pyrites is caught upon blankets and in labyrinths, and is concentrated by buddles. Some of the concentrate is treated on the spot, but according to a statement in the *Mining Journal*, "large consignments have been sent to Freiberg in Germany with the most successful results." This fact reveals either apathy or ignorance on the part of our smelters, and is not the only instance I have noticed of Colonial ores or concentrates being sent to foreign instead of British works. While wishing every success to my old friends and teachers at Freiberg, I cannot help grudging them parcels of ore, sent past our shores into the centre of Germany, which more naturally should have come to us and afforded employment for capital and labour in the mother country.

Lumps of auriferous quartz were sent by several mines, and among others from the Clunes mines which belong to the well-known Port Philip and Colonial Company, whose record of the successful treatment of stuff which is far from rich deserves notice. From 1857 to 1885, 1,298,615 tons of quartz have been crushed yielding 510,838 ounces of gold (barely 8 dwts. to the ton), worth £2,048,147, out of which a net profit of £343,444 has been paid in dividends to the shareholders, and the comparatively enormous sum of £138,877 in royalties to the fortunate owner of the land upon which the mine is situated.

The productiveness of the Bendigo gold-field, of which Sandhurst is the centre, was made apparent by a number of gilt cubes representing the output in gold of some of the principal quartz mines, and the value of the exhibits was greatly increased by a descriptive pamphlet, issued by the Administrative Council of the Bendigo School of Mines and Industries, which gives many interesting particulars concerning the most important undertakings in the district.

The best mining model in the Exhibition was sent by a successful Ballarat mine, the Band of Hope and Albion Consols. The model showed, on a scale of 1½ inch to 1 foot, a complete quartz-crushing battery with forty heads of stamps, such as are used at the Company's works, driven by a horizontal steam-engine. Each battery box has five rotating circular heads; the tappets are fixed with gibs; the feeding is by hand from large

"passes"; the discharge is in front on to amalgamated copper plates, followed by blanket strakes and shaking tables. Barrels are used for amalgamating the roasted concentrated pyrites. As the model was worked every day it naturally attracted attention, and it afforded much information to those who took the trouble to examine all its details.

Large blocks of the quartz containing iron and arsenical pyrites explained the nature of the reef which is worked. The two mines, Band of Hope and Albion Consols, which were united under one company in 1868, have produced since 1856 no less than 631,006 ounces of gold, worth £2,555,524, of which £1,108,845 have been paid in dividends.

One of the great attractions to the public was the very fine show of facsimiles of large nuggets exhibited by the Department of Mines. As full particulars of each are given in the Catalogue, I will only mention the three largest, viz.: the "Welcome" nugget, found at a depth of 180 feet at Ballarat in 1858, weighing 2195 ounces, and valued at £8780; and the "Precious" and "Viscount Canterbury" nuggets, found at Berlin at depths of 12 and 15 feet, weighing respectively 1717 ounces and 1121 ounces, and valued at £6868 and £4420.

"Wash dirt," or auriferous clayey gravel and conglomerate, from Ballarat and Haddon, was shown by the Department of Mines, and the Bank of Australia displayed samples of coarse and fine alluvial gold from the principal districts. Much alluvial gold is now obtained from the "deep leads" or old river channels of Pliocene and even Miocene age.

Iron.—The brown iron ore exhibited came from a deposit at Lal Lal in the Ballarat district, which has been worked to some extent, the ore being smelted on the spot, producing 50 per cent. of metal. No ore, however, was raised in 1885.

Lead.—Very little mining for lead is being carried on at the present time, but judging by three large blocks of solid galena from Debet Mine, Buchan, in the Gippsland district, which contain 30 ounces of silver and 1¼ ounce of gold to the ton, workable deposits exist, and no doubt in time they will be utilized.

Silver.—The silver obtained in Victoria at the present time is derived entirely from gold refined at the Melbourne mint.

Stone.—The Colony produces a great variety of building stones.

The handsome polished encrinital marble from Thomson River, Gippsland, is like the Halkyn marble of North Wales, and may be employed in a similar manner for decorative purposes. Finely vesicular basalt, known as "bluestone," is more largely quarried in Victoria than any other building stone, and though sombre in colour is strong and durable. Freestone is procured from Mount Difficult in the Grampians near Stawell. It is a fine-grained sandstone, very uniform in texture and in colour, and it was evident from the exhibits that it can be obtained in blocks of considerable size. As it hardens on exposure, it is clearly a valuable building-stone. Granite and syenite are also available.

Samples of roofing slates, 24 inches by 12 inches, gave an idea of produce of the quarries belonging to the Kara Kara Slate Company. The slate splits smoothly and is free from pyrites.

Tin Ore.—Though no tin deposits were worked in 1885, we had samples of the stream tin ore of the Gippsland and Beechworth districts, which in 1882 were thought to be very promising. Unfortunately the hopes of the diggers and colonists generally were not realized.

The quantity of gunpowder made at present in Australia is, I believe, small, but there are works about ten miles from Melbourne producing large quantities of lithofracteur, dynamite, and gun-cotton, which find a market not only in the Australian Colonies, but also in New Zealand, the Cape of Good Hope, and elsewhere. The Australian Lithofracteur Company, Limited, which owns the works, exhibited dummy cartridges, and explained by drawings the methods of using its products for blasting rock, for breaking up timber stumps or wrecks, and in torpedoes.

Before concluding, I must not fail to notice the fine collection of geological maps which formed a not unimportant part of the exhibits of the Department of Mines. Many of them were prepared during the ten years 1868–1878, when Dr. Selwyn, now Director of the Canadian Geological Survey, was Government Geologist in Victoria; others, explaining the structure of the principal gold-fields, were issued under the direction of Mr. Brough Smyth. They are on a scale of 2 inches to 1 mile, and are coloured by chromo-lithography. The map of the Ballarat gold-field is interesting as showing the "deep leads."

The "Reports of Progress" are full of valuable matter, and the annual "Reports of the Secretary for Mines and Water Supply," illustrated by numerous plates, together with the "Mineral Statistics," give very full details concerning the mining industries of the Colony.

It is not generally known in England, that the Government of Victoria, like that of some of the sister Colonies, spends several thousand pounds every year in prospecting with diamond drills and in subsidizing companies or individuals using them. Cores from 1 inch to 3¼ inches in diameter were shown by the Mines Department. They have been drawn up when prospecting for quartz reefs, for deep alluvial "leads" hidden under basaltic lava flows, or for coal seams in the Mesozoic strata. Some of these boreholes have been the means of discovering gold. The report of the Secretary for Mines, on "Diamond drills in Victoria," describes the work done up to the end of 1884, and explains many useful improvements upon the original drills imported from the United States.

In addition to the official reports just mentioned, I am indebted for information to the "Catalogue of Exhibits in the Victorian Court," the "Illustrated Handbook of Victoria" and the "Victorian Year-book for 1884–5." From the "Mineral Statistics of Victoria for the year 1885" I have obtained the following figures :—

Mineral or Metal.	Quantity raised.	Value.
		£
Antimony ore	Nil.	Nil.
Coal (lignite)	123 tons	Not stated.
Copper ore	Nil.	Nil.
Flagging	1,966 ,,	2,457
Gold	735,218 ozs.	2,940,872
Iron ore	Nil.	Nil.
Lead ore	50 tons	404
Silver (extracted from gold at the Mint)	28,951 ozs.	5,866
Slate	471 tons	942
Tin ore	Nil.	Nil.
Total Value	... ...	£2,950,541

SOUTH AUSTRALIA.

South Australia has no Government Department of Mines like Victoria and New South Wales; but nevertheless, thanks to the Commissioners for the Colony, the Adelaide Chamber of Manufactures, Mr. H. Y. L. Brown, the Government Geologist, and the proprietors and managers of some of the mines, a good collection of ores and building stones was put together.

Mr. Brown supplied also a large Geological and Mining Sketch Map of South Australia, exclusive of the Northern Territory, on a scale of 1 inch to 8 miles. He indicated by colours the chief localities where gold, copper, silver-lead and bismuth have been discovered and worked. We learn that a large area of the Colony is occupied by Tertiary and Mesozoic rocks, whilst the metallic ores are found in a broad belt of Palæozoic rocks, sometimes highly metamorphosed, extending northwards from Kangaroo Island for more than 400 miles. There is therefore a very large area of mineral-bearing country which deserves to be prospected.

Clay.—The clay exhibited by Mr. Kempson from Teatree Gully, near Adelaide, is not a pure kaolin washed from decomposed granite like Cornish china-clay, but it is the crude mineral just as it is dug from a thick bed of considerable extent.

Copper.—This metal, as was evident from the trophy of ingots over one of the entrances to the South Australian Court, is the chief staple of the mines of the Colony; but with Chili bars at £40 a ton, we cannot expect to find copper mining in a flourishing state, and we learn without surprise that many of the workings are all but, or entirely, stopped.

Kapunda, about 50 miles north of Adelaide, was the first copper mine worked in South Australia, but it was not represented by any specimens. From Burra Burra, on the other hand, there was an ample supply, and indeed there is scarcely a private collection in Europe which does not contain some malachite from this world-renowned mine. However, it was to the occurrence of the red oxide, and not of the green carbonate, at the surface, that it owed its discovery by a teamster in 1845. The ores exhibited were native copper, cuprite, malachite and chessylite, and one sample of bornite which was found below the oxidised ores. The following statistics are of interest: "The output of the mine during the twenty-nine and a half years of the Company's operation amounted to 234,648 tons of copper ore, of an average of 22 per cent., equal to 51,622 tons of copper, which, at the average price of copper, amounted to a money value of £4,749,224! The actual profits made by the Company amounted to £826,585."

From Balara Mine, 100 miles east of Adelaide, we had malachite and chalcopyrite.

Yorke's Peninsula, west of Adelaide, is an important copper-producing district, containing the Wallaroo and Moonta Mines: the former worked to a depth of 192 fathoms, the latter to 240 fathoms. Wallaroo Mine was discovered from green earth thrown up by a wombat proving to be atacamite. The gossans, containing this mineral with malachite and cuprite, led, after sinking a few fathoms, to rich copper-glance and copper-pyrites. The very complete series of seventy-five specimens supplied by Mr. H. R. Hancock showed that the vein occurs in black mica-schist and quartzite.

At Moonta Mine, a dozen miles from Wallaroo, the ore consists of chalcopyrite with much bornite and copper-glance, and the adjacent rock is a hard compact felspar porphyry. Thanks again to Mr. Hancock, the characteristics of the ore and "country" were fully illustrated.

The ores from mines situated in the country north and north-east of Port Augusta were oxidised minerals, such as malachite and cuprite, sometimes containing also a little atacamite, which probably came from shallow depths, and will turn out to be fore-runners of rich sulphides if ever the workings are extended in depth.

Copper ore is being worked at the Daly River Mines in the Northern Territory. The rich bornite exhibited reminded me of the samples from Moonta. At present the ore has to be carted 80 miles to Port Daly in order to be shipped to smelting works at Newcastle, N.S.W.; and if the mines can be made to pay under these conditions, the outlook must naturally be very promising for the time when cheaper transit will become available.

Gold.—This metal is found in various places in the Colony, and specimens were shown from the gold-fields at Barossa, Echunga and Pine Creek in the Northern Territory.

The Barossa gold-field, 34 miles north-east of Adelaide, is described by the Government Geologist, Mr. H. Y. L. Brown, in a Parliamentary Paper presented to the House of Assembly last year,* and he explains that the gold occurs in quartz reefs, in "deep leads," and in recent gravels. The reefs have not been mined to any great extent, though they promise well; the "deep leads" are similar to those of Victoria, save that they have been preserved by a capping of hard ferruginous sandstone and conglomerate instead of volcanic lavas. Sometimes the auriferous gravel itself is so compactly cemented together that it requires to be crushed. It has not been mined at a greater depth than 120 feet.

The Echunga gold-field, about twenty miles south-east of Adelaide, was discovered as long ago as 1852, but neither its alluvial deposits nor quartz reefs appear to have been largely worked.

Auriferous alluvia and reefs occur in the Northern Territory, and specimens of quartz with plenty of visible gold were exhibited by Mr. Olaf Jansen, Mr. J. R. Tennant, Messrs. Beeston Bros., and the Commissioners. The quartz generally contains more or less brown oxide of iron, and the gold is frequently seen in the cavities left by the removal of iron pyrites. The climate is undoubtedly hot, but with the aid of Chinamen the new discoveries can be thoroughly tested, and if they prove to be remunerative the reefs and placers are not likely to remain unworked.

Towards the close of the Exhibition the news was telegraphed to England of the discovery of gold at Waukaringa, about 200 miles north of Adelaide.

Iron.—Hæmatite, limonite and siderite were exhibited, but as no coal is available, South Australia cannot expect to become an iron-smelting country, though it may eventually export some of its ores. A sample of the ore from Caroona, kindly analysed for me by Mr. F. Barnett, was

* I may here mention a practice, which might be copied with advantage by the mother country, viz.: the insertion upon a parliamentary paper of the cost of producing it. Mr. Brown's report contains under the title the following note "[Estimated cost of printing (570), £5 8*s.* 6*d.* Lithographing (1 plan) £56 18*s.* 6*d.*]."

found to contain 33 per cent. of metallic manganese and 30 per cent. of metallic iron.

Lead.—The ores of this metal have been but little worked at present. Some antimonial lead ore from Aclaire mine, thirty miles east of Adelaide, is rich in silver and contains a valuable proportion of gold.

Tin.—Quite lately tin ore also has been found in the Northern Territory, both in alluvia and in the rock. The block consisting of tin ore, quartz and mica, a granite with cassiterite instead of felspar, from Cruikshank & Barret's claim in the Northern Territory, was interesting geologically, and pointed to the existence of valuable deposits. Alluvial tin was shown from Mount Wells. It is true that the climate is tropical, but Chinese labour can be had, and already the value of the tin raised is said to exceed that of the gold.

Stone.—The Adelaide Chamber of Manufactures provided a good representative collection of building stones. Excellent sandstone is abundant in the vicinity of Adelaide, and is largely used for building. The reddish dolomite from Mount Gambier takes a good polish and has a warm appearance. Quarries at Mintaro, about 100 miles north of Adelaide, produce serviceable slaty blue flagstones for pavements, and somewhat similar flags are got at Willunga, which is nearer the capital. Roofing slates are made at this latter place, but none are exhibited.

Kapunda, famous for its copper mine, possesses quarries which yield white, grey and black marble; white marble is also obtained from Angaston, and granite is procurable at Port Victor. It is evident therefore that there is no lack of material for the construction and decoration of buildings.

I have found much useful information in the Official Catalogue of the South Australian Court; and the Handbook of South Australia, prepared under the instructions of the Commissioners, contains a description of the principal copper mines, illustrated by woodcuts.

The mineral output of South Australia in 1885 was:—

Mineral or Metal.	Quantity.	Value.
		£
Copper (*metal*)	3,518 tons	194,090
Copper ore	18,639 ,,	128,893
Gold	4,692 ozs.	18,295
Lead (*metal*)	$7\frac{6}{10}$ tons	137
Lead ore	37 ,,	1,496
Manganese ore	not stated	893
Tin ore	not stated	100
Zinc	31 tons	547
Total Value	... ...	£344,451

QUEENSLAND.

In his preface to the Catalogue of the Ores and Minerals exhibited from Queensland, Mr. A. W. Clarke alludes to the physical difficulties encountered in preparing the collection at short notice, and when we find

nevertheless that it consisted, exclusive of fossils, of more than 1400 specimens from all the most important mining localities, we cannot but admire the energy shown in getting together such a splendid display of the mineral wealth of the Colony.

Antimony.—Three fine specimens of stibnite came from Emily Lease Mine at Northcote, near Thornborough. The vein is interesting as having been worked at first for gold. The ore has been smelted on the spot, and products from the works accompanied the samples from the mine.

Coal.—The show of coal was not imposing, and was very far from doing justice to the resources of Queensland. However, the Catalogue contains extracts from the Rev. J. E. Tenison-Woods' pamphlet,* which explain that large quantities of valuable and workable coal exist in various parts of the Colony, and the author predicts that eventually the shores of Queensland will be "the grand coal emporium of the Southern Hemisphere."

The samples exhibited came from the Ipswich coal-field and the Burrum or Wide Bay coal-field, the only two districts where coal is now being mined.

The Ipswich collieries are all comparatively small at present, the largest, the Aberdare Mine, having an output of only 50,000 tons a year. The coal it produces is stated to give excellent coke and to be valuable for steam, smiths' or furnace work. It burns freely and leaves 8 per cent. of soft ash.

A laboratory analysis gave :—

Volatile in coking	32·3 per cent.
Fixed carbon	62·9 ,,
Ash	4·8 ,,
	100·0

From the Borehole Coal Company's mine, Bundanba, in the same district and only twenty-one miles from Brisbane, there were samples of four seams, varying from 3 feet 6 inches to 9 feet in thickness, which produce good steam and gas coal. The quality of the Bundanba main seam was also manifested by a sample sent by Messrs. Stafford Bros. It looked dirty and is stated to have 16 per cent. of ash; however, it is a useful hard steam coal which cokes well.

An analysis gave the following results :—

Volatile in coking	28·7 per cent.
Fixed carbon	64·0 ,,
Ash	7·3 ,,
	100·0

Mr. A. C. Gregory, C.M.G., from practical trials, considers it to have an economic value equal to the average of coals from Newcastle, New South Wales.

His general opinion of the Ipswich coal is summed up in his official report as follows : "In the Ipswich division the coals are bituminous, coking well; the proportion of gas being small and the fixed carbon large, they are suitable for forges and blast furnaces; are good steam coal when not

* "The Coal Resources of Queensland," by the Rev. J. E. Tenison-Woods.

broken too small; but are so friable as not to bear carriage well, and suffer from exposure to wet; so that the harder varieties, though containing most ash, are found in practice to be most economical, in consequence of the smaller proportion of waste." However, between Walloon and Warwick, 165 miles south-west of Brisbane, the general character of the coal is more like that of cannel.

The Burrum coal-field was represented by specimens from the Torbanelea Colliery and the Queensland Colliery. The former is about fifteen miles north of Maryborough on the Burrum Railway. The seam is 6 feet 2 inches thick, made up of two beds respectively 3 feet 6 inches and 2 feet 8 inches thick, separated by 12 inches of fire-clay. The coal is bituminous, yields a strong coke, and is useful for steam purposes or making gas. In 1885 this colliery produced 10,500 tons of coal. The coal is conveyed to Maryborough by rail and there put on board ship.

The Queensland Collieries are at Howard, also near Maryborough. The section of the mine accompanying the block of coal showed that the seam has a regular and gentle dip, and is free from faults.

The coal from the Ipswich district is considered to be of Mesozoic age, whilst the Burrum measures and various coal-fields to the north, which are as yet wholly undeveloped, belong to Palæozoic rocks. As I have already said, no true idea of the wealth of the Colony in coal could be formed from the meagre exhibits, and it is necessary to read and consider various official reports in order to realize the full importance of the Queensland coal-fields.

Copper.—The richness of the Cloncurry district in copper was evidenced by numerous fine specimens of native copper, cuprite, black oxide of copper and malachite, which no doubt have come from shallow depths and are the precursors of sulphides. The workings belonging to the Cloncurry Copper Mining Company appear to be scattered over a considerable tract of country, for some of the samples came from the Dugald River, forty-five miles N.W. of Cloncurry, others from a mine forty-five miles to the east, and others from the S.W. of the little settlement. At present the mines are heavily handicapped by their distance from a port or railway, as they can only be reached by a journey of 200 miles from the Gulf of Carpentaria, or a still longer coach ride from the nearest railway station to the east. In spite of these drawbacks and the low price of copper, the rich ores are being worked, and we may reasonably expect Queensland to become a large producer of the metal when the Cloncurry district is provided with a railway.

A huge block of ore, weighing 1¼ tons, rich in carbonate of copper and yielding 27½ per cent. of metal by assay, deserves special mention. It came from the head of the Leichhardt River, and was obtained at the surface from a lode 25 feet wide.

The Peak Downs district, about 200 miles west of Rockhampton, though no longer worked for copper, was at one time remarkable for its richness, and Mr. Salmon's collection contained specimens of rich ores, such as oxides and carbonates, together with native copper and chalcopyrite.

Gold.—With the exception of Victoria, Queensland is now producing more gold than any other British Colony, and it was very natural therefore to find a large amount of space devoted to the metal which has contributed so much to its prosperity.

The principal gold-fields are classed into three groups, viz. : the Northern, including the Palmer, Hodgkinson, Ravenswood, Charters Towers, Etheridge and Woolgar districts; the Central, comprising the Rockhampton, Mount Morgan, Clermont, Port Curtis and Nebo districts; and lastly, the Southern, in which the Gympie district is the most important.

The seven gilt cubes which told us the total yield of the principal gold-fields, afforded no idea of their relative productiveness at the present time, but this may be ascertained by consulting statistics published in the Annual Report of the Department of Mines. From them we learn that out of 310,941 ounces produced by Queensland in 1885, the Charters Towers and Cape River gold-field produced 134,650 ounces, or 43·6 per cent. of the total; next in importance comes the Gympie gold-field with 89,600 ounces, or 28·8 per cent. of the total, leaving the remaining 27 per cent. distributed among the other districts.

The main features of the various gold-fields were illustrated by very extensive collections supplied by the Commissioners, who sent not only picked specimens, but also samples of the ore in bulk. I noticed specially the white quartz with scarcely any pyrites from Gympie, the quartz with varying proportions of iron pyrites, galena and blende from Charters Towers, and the dark-looking troublesome ores from Ravenswood. These latter consist of mixtures of quartz, galena, blende, iron pyrites, chalcopyrite and mispickel, which refuse to yield up their gold when treated by the ordinary amalgamation process, and have to be smelted. The ore is picked by hand, and the poor stuff concentrated by jigging, and the comparatively rich product thus obtained is either smelted on the spot or shipped to Germany. The Ravenswood Gold Smelting Company is able to procure galena in the neighbourhood, and treating this in a water-jacket furnace with the roasted auriferous sulphides, obtains pig-lead rich in gold and silver. Large samples explained very fully how the Ravenswood ores are prepared for treatment either at home or in Europe.

Though not attractive to the multitude, the stuff sent from Mount Morgan, near Rockhampton, requires special comment, as it came from a deposit which is remarkable from a geological as well as from a commercial point of view. The auriferous deposit, which is worked as an open quarry, is a mass of brown hæmatite, sometimes stalactitic, containing a little silica, which passes gradually into a silicious sinter. Both the sinter and the hæmatite contain gold, and yield on assay from 3 to 10 ounces of gold to the ton. The average yield on crushing of the limonite, such as is exhibited, has been as much as 7 ounces of gold to the ton. Mr. Robert L. Jack, the Government Geologist of Queensland, who has done so much in exploring and describing the mineral treasures of the Colony, is of opinion that this mass of auriferous limonite and sinter is the product of a geyser. Without having examined the deposit on the spot, I scarcely dare criticize the conclusions of so able an observer as Mr. Jack; but I must confess that the specimens exhibited did not seem to me conclusive that Mr. Jack's views are correct. I failed to find any of the frothy, spongy, cellular sinter which he describes, such as will float on water, and it is therefore scarcely fair to sit in judgment with important evidence omitted. At present the case seems to me "not proven." However, leaving aside all question of origin, a mass 300 feet wide which can be worked as an open quarry, and yields 7 ounces of gold to the ton, is truly phenomenal. The metal pro-

duced is of extreme purity, and contains 99·7 per cent. of gold, the rest being copper, a trace of iron, and a minute trace of silver. Dr. Leibius, of the Sydney Mint, speaks of it as the richest native gold hitherto found. Works are now being erected for treating the stone by calcination and chlorination. Specimens of auriferous ironstone from Mount Leyshon, sixteen miles south of Charters Towers, made known another curious gold deposit, as the repository of the precious metal is supposed to be the neck or core of an old ash-discharging volcano.

Among the mining exhibits I wish to call special attention to four excellent drawings by Mr. Joseph Shakespeare, one of the two Inspectors of Mines. They showed, on a scale of $\frac{1}{24}$, the nature of the gold vein, and the method of working at Day Dawn Block Mine, which furnished such rich specimens of auriferous quartz. The first was a cross-section of the lode explaining its structure. No. 2 showed the mode of timbering adopted in this big vein, which was figured as 21 feet in width: A hard wood bearer 30 feet long and 14 inches square reaches from one wall to the other, and rests in deep recesses or "hitches"; it supports two other large balks which keep up, one the hanging wall, the other the "deads." In the triangle thus formed additional sets of timber are arranged which enclose the working level. Section 3 showed how the wide lode is stoped away overhand, and the excavation rendered secure by being filled with "deads," while a portion of the lode and the hanging wall are temporarily supported by "cribwork," or chocks of timber laid crosswise. Mr. Shakespeare also sent some sections, on a scale of $\frac{1}{48}$, of various other gold veins in the Charters Towers district. They are fully described in the Catalogue. Their careful execution deserves much praise, and they form an interesting record for the miner and the geologist.

The Quartz Crushing Mill may be fairly mentioned as one of the greatest attractions of the whole Exhibition, and the British public are greatly indebted to the energy of Queensland for giving them an opportunity of learning how gold is extracted from the matrix in which it is found.

The battery, which was constructed by Messrs. J. Walker and Co., of Maryborough, Queensland, looked quite graceful compared with the clumsy Cornish stamps, and yet conveyed the impression of ample solidity and strength. The frame-work was of cast-iron, resting upon a foundation of the hard and heavy Australian timber known as Iron-bark. The battery consisted of five heads of the California or revolving type, each head and lifter weighing 800 lbs., and making 80 drops of 9 inches a minute. The tappets were screwed and were provided with steel rings to take the wear.

As is usual in Queensland, the stamps were fed by hand and not automatically. The battery box had a front discharge only, through a screen made of perforated sheet iron or fine wire gauze. The stamped ore passed on to amalgamated copper plates, silvered previous to amalgamation, and kept bright by being rubbed at regular intervals with cyanide of potassium, but I should not omit to say that some of the gold was caught in the "kofer" or battery box, as a little quicksilver was dropped in every quarter of an hour. In addition, some was retained in the mercury wells, which are narrow transverse gutters partly filled with quicksilver between the copper plates, whilst other gutters called "ripples" arrested some of the pyrites. The sand which had passed over the copper plates, wells, and

ripples, fell on to a shaking table, which caught the heaviest particles, whilst the fine light ones were allowed to run away. The deposit on the shaking table was shovelled off from time to time into a Wheeler's pan and this discharged into a Berdan revolving pan; the latter overflowed into a revolving settler, and the escaping muddy water no longer contained anything that it paid to treat. The greater part of the gold was caught in the battery box and on the first copper plate. The amalgam which was scraped off was retorted and the spongy gold melted into bars. The full series of processes was thus carried out at the Exhibition.

Although the stamps were kept going only two or three hours a day, several parcels of Queensland ore were treated. Forty-eight tons of Day Dawn quartz yielded 98 ounces of bar gold; 20 tons of North Phœnix ore, Gympie, produced 56 ounces of gold; and $7\frac{1}{8}$ tons of stuff from Disraeli Syndicate gave 27 ounces of gold.

The treatment of alluvial wash-dirt was also shown, and the operations of the Queensland digger were always carefully watched by an admiring crowd as he used the old-fashioned tub or cradle.

I repeat that the working of an actual quartz mill contributed largely to the interest of the Colonial Exhibition, and as a young Colony, with a total population about equal to that of Cornwall, Queensland deserves great credit for having provided at considerable expense so excellent a show, which enabled the whole process of gold extraction to be followed in London as fully as it could be at the gold-fields themselves.

Iron.—Though the energies of the Queensland miners are mainly devoted to gold and tin, the metal iron does not escape their attention, and specimens of red and brown hæmatite were shown from the Ravenswood district. The red hæmatite is being raised for smelting purposes.

Lead and Silver.—The Tinaroo district or region about Herberton, some 50 miles from the port of Cairns, sent proofs that its mineral wealth is not confined to the tin ore which led to its being opened out for mining six years ago. Galena rich in silver and ferruginous gossans containing large amounts of horn-silver are now being worked, and a furnace has been erected for smelting these ores on the spot. The specimens sent for exhibition all came from shallow depths, such as 20 or at most 45 feet, so that lead and silver mining is quite in its infancy at present. During the year 1885 this district produced 2600 tons of argentiferous lead ore, estimated to contain 187,203 ounces of silver and to be worth £36,587.

A huge block of galena and sundry smaller specimens from Ravenswood showed us the remedy that Nature has provided for the treatment of the refractory ores of this district, already referred to in speaking of gold. In addition to argentiferous galena, the lode worked by the Ravenswood Silver Mining Company produces an ore yielding from 500 to 5000 ounces of silver per ton, and considered to be a mixture of fahlerz and zinc blende.

Quicksilver.—Kilkivan, to the west of Gympie, is notable for yielding a limestone containing cinnabar. It is treated at works on the spot, and the quicksilver finds a ready market at the gold-fields.

Stone.—The value and interest of the collection of building materials was greatly enhanced by the notes supplied in the Catalogue by the Hon. A. C. Gregory. It is evident that the Colony possesses good stone for the

construction of public and private buildings, and is independent of other countries for their decoration.

I noticed especially the polished marble from Gladstone; some of it is mottled yellow, grey, and white; there was also handsome brecciated reddish marble; another specimen was a white marble with green and brown stains. Rockhampton sent a dark grey marble.

Sandstone is abundant. From quarries at Helidon, about 70 miles west of Brisbane, we had a fine-grained white sandstone, uniform in texture and colour and easily sculptured, and also a warmer-looking purplish stone. Stanwell, Rockhampton, sent pink marble and brown sandstone. An excellent sandstone, slightly brownish, came from Grantham, and if harder stone is required there is syenite from Gladstone, or the compact purplish porphyry from Brisbane.

Tin.—Next in importance to gold comes tin ore. Thanks to the efforts of the Queensland Commissioners, Messrs. John Moffat and Co., the Herberton Local Committee and the Stanthorpe Local Committee, there was a very striking display of ore from the two principal tin-fields, Stanthorpe and Herberton.

The Stanthorpe district is on the southern border of the Colony and adjoins the rich stanniferous region of New South Wales. Its tin was discovered in 1872, and for several years large quantities of stream tin were obtained from alluvial diggings, but now it is completely thrown into the shade by the Tinaroo or Herberton district near Cairns and Port Douglas in the north. The extraordinary productiveness of this new mining region, which in addition to tin produces gold, silver, copper, lead, and bismuth, was well illustrated by carefully arranged collections; and it was evident from the specimens and the statements contained in the Catalogue that, in addition to stream tin, there are ample supplies of lode tin awaiting the miner's pick. Experience in Cornwall shows very decidedly that tin lodes maintain their productiveness at least to a depth of half a mile, and therefore even when the alluvial diggings are exhausted it may be expected that the Herberton district will continue to furnish regular supplies of the metal.

Messrs. John Moffat and Co. sent twenty tons of ingots of tin surrounded by samples of rough tinstone, "country" rock and bags of clean ore, destined to convince the most sceptical of the resources of the new region.

It was evident from the collections that tin ore occurs with the minerals usually associated with it in Great Britain and other countries, viz., quartz, iron pyrites, mispickel, red hæmatite, chlorite, fluor spar, tourmaline, wolfram, and some of the ores of copper.

The large block of tin ore from the workings of the North Australian Tin Mining Company, at Watsonville, near Herberton, was a very fine specimen, and one can easily understand that with much stuff like this "tin-ore to the value of £50,000 was taken from this mine in two years by six men; it is still one of the best paying mines in the district."

The general richness of the stanniferous rock will be realized when we learn that the 12,834 tons crushed in the Tinaroo district in 1885 yielded 2096 tons of clean tin-ore fit for the smelter (*black tin*); 400 tons of this were produced by the Great Northern Freehold Mine from 1400 tons of stuff.

In addition to the minerals already described, plumbago, chromic iron, and ores of cobalt and manganese were exhibited.

I must not conclude without mentioning as a valuable contribution to science the geological map of Queensland on a scale of 1 inch to 16 miles by Mr. Robert L. Jack, and I must further say that I am indebted for information to the following publications, most of which were compiled specially for the Exhibition :—

Catalogue of the Exhibits of the Queensland Court. Price 6*d.*

Handbook of Queensland Geology. By Robert L. Jack. London, 1886. Price 2*d.*

The Mineral Industries of Queensland. By K. T. Staiger. London, 1866. Price 2*d.*

The Charters Towers Gold Field, Queensland: Its rise and progress. London, 1886. Price 2*d.*

Mount Morgan Gold Deposits. Report by Robert L. Jack, Government Geologist. Brisbane, 1884. Price 5*d.*

Annual Report of the Department of Mines, Queensland, for the year 1885. Brisbane, 1886.

The following table gives the output of minerals and metals in Queensland during the year 1885 :

Mineral or Metal.	Quantity raised or produced.	Value.
		£
Antimony ore	70 tons	300
Coal	209,698 ,,	87,228
Copper ore	1,340 ,,	18,926
Gold (value estimated at £3 10*s.* per oz.) .	310,941 ozs.	1,088,293
Lead and Silver ores	7,124 tons	64,235
Tin ore (some dressed, but mainly undressed ore)	13,992 ,,	151,871
Total Value. .	... ...	£1,410,847

WESTERN AUSTRALIA.

Western Australia as a mining country must be judged by the future and not by the past, for up to the present time comparatively little has been done to develop its mineral wealth.

Copper.—Blocks of rich copper ore containing cuprite and malachite were sent from a lode lately discovered in the Champion Bay district, forty miles north of Northampton; and some dressed chalcopyrite came from Geraldton. While the metal fetches such ruinously low prices people are not likely to devote so much attention to copper mining as they would have done some years ago, especially as the colonists can find so many other channels for the profitable employment of capital. However, we may fairly expect that some day the copper lodes will be turned to good account.

Gold.—The exhibit of gold was interesting, as it came from the Kimber-

ley district, the capabilities of which are now being tested by some 3000 miners. The new gold-field is situated in the northern part of the colony along the Elvire, Panton, and Ord rivers. Derby, on King's Sound, 370 miles distant, is the nearest port. All the gold now being raised comes from alluvial diggings. The Commission displayed a collection of nuggets and coarse gold, which apparently confirm Mr. Hardman's prediction, made in his preliminary report of 1883, that payable gold exists. A large nugget, which was received after the opening of the Exhibition, weighed 28 ozs. 6 dwts. Mr. Hardman speaks of a large number of auriferous quartz reefs occurring in metamorphic rocks, which probably are a continuation of the gold-bearing formation which is yielding the precious metal in the Northern Territory of the Colony of South Australia. Though the gold district is well within the tropics it is said to be not unhealthy. If gold mining can be made to pay on the Ord River, as is confidently expected by Mr. Hardman and many others, the existence of one gold-field will probably lead to the discovery of others, and the year 1886 will witness the dawn of a new era of prosperity for Western Australia.

Iron.—An ample supply of rich ironstone exists at Coates Hill, thirty-six miles from Perth, and good brown hæmatite was shown from the Vasse district; however, these deposits are not likely to be utilized just at present, when no coal is available on the spot, and when existing smelting works in other countries can be supplied from more accessible localities.

Lead.—Galena was at one time successfully worked in the Northampton district, now connected with the coast by a railway thirty-four miles in length. Large lumps of very pure ore were shown from St. Geraldine and Badra mines, but though rich in lead they contain no silver of any value. In 1885 only 465 tons of ore were exported, and now lead mining is said to be practically at a standstill, the low price of the metal having rendered lead mining unprofitable in the Colony as it has done in Great Britain. The ore produced used to be shipped to Llanelly and there smelted.

Stone.—Granite is plentiful, and is quarried and used for building. A pedestal from York Green Mount was exhibited.

The fine-grained white sandstone, known as the White Peak stone, and obtained ten miles from Geraldton, is easily worked, and will be useful not only as an ordinary building stone, but also where ornamentation is required.

When we reflect upon the enormous area of Western Australia, equal to eight times that of Great Britain, with a population of only 35,186, of whom one-third are massed in the two principal towns of Perth and Fremantle, we are not surprised that the mineral resources of the Colony have remained undeveloped, especially in these later years when the low prices of copper and lead have rendered mining the ores of these metals wholly unprofitable except in a few special and favoured localities.

There is no Geological Survey or Mining Department, but reports upon the geology of the Colony have been made by Mr. Hardman, who accompanied two exploring expeditions, and also by Mr. H. Y. L. Brown; extracts from the reports of the former will be found in the "Catalogue of the Exhibits in the Western Australian Court" (Price *2d.*), and also in the useful pamphlet entitled "Notes on Western Australia," by the Hon. John Forrest, C.M.G. (Perth, 1886), which contains a map of the Colony. The Rev. C. G. Nicolay's "Notes on the Geology of Western Australia"

(London, 1886) sum up what is known concerning the mineral deposits of the Colony.

In concluding my remarks upon Australasia, I may state that much valuable information concerning the Mines Departments and Mineral produce of the various Colonies, including Tasmania, is contained in "The Year-Book of Australia" published annually in London.

NEW ZEALAND.

No visitor to the New Zealand Court could fail to notice the admirable relief model of the Colony, coloured geologically, on a scale of 1 inch to 4 miles horizontal, and 4000 feet vertical. It was constructed by Dr. James Hector, C.M.G., Director of the New Zealand Geological Survey, whose contributions to the Exhibition were of great importance and interest, especially as they were accompanied by a detailed illustrated catalogue provided with a coloured geological map. This map was reduced from a large one on a scale of 1 inch to 12 miles, hung up in the Court, from which we learnt that the coal-bearing Upper Mesozoic rocks occupy 4500 square miles, whilst foliated schists, the home of mineral veins, are largely developed, especially in the Otago district. The general collection of the ores and minerals made under Dr. Hector's directions, was well arranged and clearly displayed; and as it was supplemented by contributions from the Minister of Mines, the Public Works Department, and numerous Companies and private persons, the wealth of the Colony in coal, metallic ores and stone was brought before the British Public in a plain and conspicuous manner.

Antimony.—A table covered with splendid blocks of clean and solid stibnite and ingots of star antimony, showed us the rich ore raised at Endeavour Inlet near Picton in Cook's Strait, and the products of the local smelting works. Stibnite is found in other localities, and sometimes accompanies or carries gold. The stibnite from Inangahua yields about 100 oz. of gold to the ore.

Coal.—Coal-mining has now become an important branch of trade in New Zealand, and as the yearly output is increasing in a steady and regular manner, there is no doubt that the industry is established upon a firm footing.

The Geological Survey by a series of twenty-nine well-chosen examples showed that many varieties of mineral fuel are to be found; viz., brown coal, pitch coal, glance coal, bituminous coal, and anthracite; whilst large blocks from some of the principal collieries, enabled us to estimate the importance of the seams. All these coals are of Cretaceous or Tertiary age.

The principal localities where bituminous coal is being worked are near the Buller and Grey Rivers, both on the west coast of the Middle Island. Though the measures are considered to be Cretaceous, they furnish a true bituminous coal of good quality. From the Buller district there were large blocks of coal illustrating the nature of the 19-foot seam at Coalbrookdale Colliery, and the immense seam 53 feet in thickness at Granite Creek. Turning to the Grey River districts we again find large seams, and it appeared from the exhibits that at the Brunner Colliery a 17-foot seam is

worked, and that at Wallsend and Coal-pit Heath Collieries the seams attain thicknesses of 18 feet and 16 feet respectively. The Brunner seam is free from disturbances, and most of it can be worked above the water-level. Its coal furnishes a superior coke. The output from the Brunner Colliery in 1885 was 104,001 tons.

However, these are not the only coal-fields. Semi-bituminous coal is worked at Kawakawa, Bay of Islands, and brown coal at Whangarei, both north of Auckland. In the Middle Island bituminous coal is raised at Collingwood, in the extreme north of the province of Nelson, and in the Pelorus district, nearer its chief town. Proceeding southward we come to the Malvern district, some 40 miles west of Christchurch, where seams of brown coal, varying from 3 feet 6 inches to 25 feet in thickness, are being worked. Further south again lies the important Otago district, with collieries near the coast, from which large supplies of good brown coal are being obtained. The seams are of considerable thickness, often reaching to and exceeding 20 feet. Thus the blocks of clean brown coal sent by the Kaitangata Railway and Coal Company, Limited, came from beds which are respectively 24 and 30 feet thick, and a seam 40 feet thick is worked in two localities. Finally, lignite and pitch coal are mined in the extreme south of the Middle Island.

We learn from Dr. Hector that the Buller coal-field contains "140,000,000 tons of bituminous coal of the best quality and easily accessible"; the Grey district is estimated to contain 50,000,000 tons; whilst at Kaitangata alone 6000 acres of coal-producing land will yield "140,000,000 tons, nearly the whole of which would be available without sinking." From these facts it is very evident that the coal resources of New Zealand are considerable, and there can be no doubt that Dr. Hector is correct in asserting that, after the completion of certain railway extensions, shipping facilities and harbour improvements, the collieries will be more largely worked and will furnish increased supplies for home consumption as well as for export.

Copper.—According to the latest statistics no copper ore was exported in 1885, and consequently it may be assumed that copper-mining is now completely at a standstill in New Zealand, as it is in many other countries. Nevertheless, there was a good display of chalcopyrite, from the Champion Copper Mine in the Aniseed Valley near Nelson, and huge slabs of native copper from the serpentinous rock, reminding one of a similar occurrence of the metal at the Lizard in Cornwall. Sometimes the serpentine is impregnated through and through with fine particles of the metal, as was shown by other specimens from Aniseed Valley. The rock is said to yield on an average 3 per cent. of metal by assay, and if anything like this amount can be extracted economically, there is a fine field for mining, as the supply of easily accessible cupriferous serpentine is abundant.

Gold.—Gold occurs in and is extracted from three kinds of deposits: I. Quartz veins; II. Alluvial deposits; III. Recent sea-beaches.

I. The most important quartz reefs are found in the Coromandel district on the Cape Colville Peninsula, and in the Thames district a little to the south. Some of the principal mines were well represented by rich specimens, and sent in addition full statements of the results obtained by crushing, which afford a better test of the true value of a mine than picked samples.

Thus not only could we see a lump of auriferous quartz from the Cambria Mine, Thames, weighing 105 lbs., so full of gold that it is valued

at £140; but we also learnt that 12,471 tons of quartz, most of which was crushed in 1885, yielded 28,261 ozs. of gold, worth £78,778. Upon a capital of £1837 10*s.* paid up in 1884, dividends to the amount of £48,825 had been declared by the beginning of December, 1885. The samples from the New Prince Imperial Mine, Thames, were also accompanied by statistics. The mine was bought by auction four years ago for £250; since then, upon a capital of £696 or £946, including the purchase-money, 30,014 tons of quartz and 11 tons of auriferous specimens have been raised and crushed, yielding 41,473 ounces of bar gold worth £114,136. From this the shareholders have received £60,750 in dividends. The Company's exhibit was specially interesting, as showing the sandstone rock in which the veins prove to be richest. This, according to Sir Julius von Haast, is the rule in the district, for the veins are remunerative in a pyritiferous felspathic sandstone, probably a volcanic ash, whilst they are poor or die out altogether on entering the harder diorite or underlying slate. Here we have another instance of the manner in which a pyritiferous "country" is productive of riches, and though the belt of congenial sandstone at New Prince Imperial Mine is 60 to 80 feet thick, it reminds us by its effects of the very thin indicators at Ballarat.

Space will not allow me to dilate any further upon the mines which send specimens. I can merely say that the auriferous quartz varies a good deal in character; some is quite white, other is rusty, full of casts of iron pyrites crystals, some is greyish, and some is associated with galena, iron pyrites, blende and copper pyrites. Stibnite and heavy spar accompany the gold at the Cambria Mine; in fact the former mineral does not seem to be uncommon, and a fine crystallized specimen is exhibited from Prince Imperial Mine.

It will be inferred from the low price obtained for the Thames gold that it is of a low standard. It is largely alloyed with silver, as shown by the following assay of a bar:—

Gold	65·65
Silver	33·9
Copper	00·45
	100·000

In the Otago district auriferous quartz reefs occur in the Upper Foliated Schists, which probably are altered Silurian rocks; they are true fissure veins cutting across the planes of foliation, and are extensively worked. In the Middle Schists there is also gold in thin layers of quartz parallel to the planes of foliation, which no doubt furnished much gold to the alluvial deposits.

II. The gold-bearing alluvia of New Zealand are of various ages. The auriferous cements worked at Reefton belong to the Cretaceous period, but the richest gravels are Pliocene. They are spread over the country in beds, often several hundred feet thick, especially in the Otago and Westland districts, and though not rich in gold, can be profitably worked by the hydraulic process, as water is abundant. The auriferous gravel is frequently cemented into a hard conglomerate which requires to be stamped.

A large number of samples in bottles showed the nature of the auriferous wash-dirt, which is often a white, grey, or yellowish gravel, and this collec-

tion was rendered complete by a series of nuggets and fine gold extracted by washing.

Auriferous cement was also exhibited in the form of a brown ferruginous sandstone from Nelson, and greenish-grey conglomerate from Otago.

Some alluvial gold is obtained by dredging sand and gravel from the bottoms of existing rivers; the dredgers are worked by steam or by paddle-wheels driven by the force of the current.

III. The auriferous sand of some of the recent sea-beaches is derived from gold carried down by the rivers, both naturally and in the tailings discharged into them by mines. Some sand exhibited from the sea-beach at Thames yields 1¾ oz. of gold to the ton, as it is gathered, and 4 ozs. 4 dwts. when concentrated; it is not surprising to learn therefore these deposits are worked for gold.

Before concluding the subject of gold, it may be well to mention that large heaps of auriferous tailings exist in New Zealand as in Australia, awaiting the discovery of some cheap method of extracting the gold still remaining in them.

Iron.—The most abundant iron ore in New Zealand appears to be the brown hæmatite found at Parapara, Nelson. Two large blocks of it were shown, as well as small specimens of red hæmatite and spathic iron. The sands of some of the New Zealand beaches have offered a tempting field to smelters, but hitherto commercial success has not attended the efforts to utilize the iron contained in them.

Kauri Gum.—It may be objected that this is a vegetable product and does not come within my province. I find it mentioned in the official list of "Mineral Productions" of the Colony, and I am informed by Sir Julius von Haast that most of this gum is dug up from the sites of old forests, where for centuries past no Kauri trees have been growing. But on the other hand, he has pointed out to me that the difference between this semi-fossil gum and that exuding from living trees is not great, and that moreover the oldest gum is far softer than amber. Nevertheless Kauri gum constitutes such an important item in the exports of New Zealand that it cannot be passed over without at least a passing mention.

Manganese.—The fine lumps of psilomelane shown by Mr. John Phillips from Waikatu, Bay of Islands, came from a deposit which is being successfully worked. Manganese ores occur in several other localities.

Silver.—It seems somewhat strange to say that the New Zealand gold is the chief source of its silver, but such is literally the case; the silver obtained in the Colony is derived mainly from the bars of argentiferous gold produced at the Thames mines.

A rich silver-bearing ore, called Richmondite, was at one time mined at Richmond Hill, Nelson. It is a mechanical mixture of galena, tetrahedrite, and other minerals, and in outward appearance somewhat resembles the troublesome "bluestone" found in Anglesey; but it is far richer in silver, and yields 20 to 1790 ounces per ton.

Stone.—The exhibit of the Public Works Department, Wellington, included a variety of stones. A common material largely employed for building, road metal, and kerbs is the so-called "blue-stone," a finely vesicular basalt, which may be used either rough or dressed, and is very durable. Good granite is also available. Limestone is plentiful, and is quarried in various places. Good blocks of it were displayed, as well as

marble from Kamo, Whangarei. When ornamentation is required there is an abundant supply of the Oamaru stone, which is very extensively quarried. It is a granular calcareous sandstone, somewhat porous perhaps, but easily worked even by wood-carving machinery. As it can be sold free on board in Oamaru at 9*d.* per cubic foot, it is not surprising that it finds a good sale in the Australian colonies as well as in New Zealand. Serviceable white and yellow sands suitable for glass-making are obtained at Mount Somers, and that good pottery clays exist is amply proved by exhibits of manufactured products.

Samples of graphite, rolled cinnabar, galena, and zinc blende showed that these minerals, though not worked, are not wanting; and a block of chromic iron came from a deposit in the serpentine near Nelson, which, from 1853 to 1866, furnished 5306 tons for export.

The output of minerals and metals in New Zealand in 1885 is shown by the following table:—

Mineral or Metal.	Quantity raised or produced.	Value.
		£
Antimony ore	666 tons	5,289
	Tons.	
Coal. Bituminous coal	257,794	
Coal. Pitch and brown coal	237,216	
Coal. Lignite	16,053	
Coal.	511,063 ,,	400,000*
Gold	237,371 ozs.	948,615
Kauri gum	5,875½ tons	299,762
Iron ore	50½ ,,	208
Manganese ore	602 ,,	1,716
Mixed minerals	114 ,,	993
Silver	16,624 ozs.	3,169
Total Value	... ...	£1,659,752

* Value estimated. 43,893 tons of coal exported from New Zealand are valued at £51,257.

In addition to the notes on the labels of the specimens, I am indebted for information to the following sources:—

Catalogue of the New Zealand Exhibits. London, 1886. Price 6*d.*

Handbook of New Zealand. By James Hector, M.D., C.M.G., F.R.S. Wellington, 1886. With two maps.

New Zealand Geological Survey Department. Detailed Catalogue and Guide to the Geological Exhibits. By James Hector, M.D., C.M.G., F.R.S., Director. Wellington, 1886. With coloured geological map.

The Mineral Resources of New Zealand. By Sir Julius von Haast, Ph.D., K.C.M.G. Lecture reported in the Mining Journal, Vol. LVI., 1886, p. 950.

Annual Reports of the Inspectors of Mines for 1885. Wellington, 1886.

Report on Gold-fields, Roads, Water-races, and other works in connection with Mining for the year ended 31st March, 1886. By H. A. Gordon, Inspecting Engineer. Wellington, 1886.

Mines Statement by the Minister of Mines, the Hon. W. J. M. Larnach, C.M.G. Delivered 6th July, 1886.

CAPE OF GOOD HOPE.

The Cape of Good Hope Court was specially interesting on account of the illustrations of the mode of mining, washing, and cutting diamonds; but before proceeding to speak of the extraction of the gems, two other minerals claim our attention.

Coal.—Though not proved to be rich in coal, the Colony possesses seams which are being worked north of the Stormberg Mountains in strata of Mesozoic age. The coal exhibited came from collieries at Fairview, Molteno and Cyphergat, close to the railway from East London Harbour to Aliwal North, and Indwe, about 20 miles east of Dordrecht.

The seam at Fairview is small, only 2 feet 11 inches thick, made up of three beds of coal respectively 8 inches, 4 inches, and 15 inches thick, separated by two 4-inch partings of shale; 3000 tons were raised in 1885, and sold on the railway at 17*s.* per ton.

At Molteno the seam is somewhat thicker, viz., 3 feet 10 inches, and consists of 2 feet 6 inches of workable coal, separated into three beds by two partings of shale. This district is estimated to contain 40,000,000 tons of coal.

The Cyphergat seam again is small and dirty. It is made up of beds 8 inches, 4 inches, and 17 inches thick, separated by thin beds of shale, making a total thickness of 2 feet 5 inches of workable coal. The output for the year ended 30th June, 1885, was 7033 tons. The coal is used for locomotive and household purposes.

A painted board represented the full size of the Indwe seam, which is 14 feet 4 inches thick, consisting of eight beds of coal separated by layers of shale. The upper half only is worked, containing four beds of coal, respectively 7 inches, 6 inches, 2 feet 4 inches, and 10 inches thick, making up 4 feet 3 inches of workable coal. It is estimated that there are 10,000 acres of coal-bearing land which will produce 4000 tons per acre. It is expected that the coal from the Indwe mine will eventually be sold at 10*s.* per ton. The collieries have the advantage of being worked from adit levels and by native labour, of course under European supervision, and, though the seams are thin and the coal burdened with a high percentage of ash, they can compete successfully with British and Australian mines in supplying railways and local consumption; but the fire-bars of the locomotives have to be specially arranged for getting rid of the ash.

Copper.—Ores of this metal occur in abundance at Ookiep in Namaqualand, about 100 miles south-east of the mouth of the Orange River.

The Cape Copper Mining Company had a grand show of lumps of bornite and chalcopyrite of exceptional purity; the bornite was specially striking. Of course it cannot be expected that all the ore raised should be free from vein-stuff; some has to be dressed, and specimens of jigged and buddled ore explained the state of concentration to which it is brought. The ore is sent away by rail to Port Nolloth. The line, which is the property of the company, cost £169,218, and is an instance of a railway constructed solely for mines without having any local traffic to depend on. From Port Nolloth the ore is shipped to the company's works at Swansea, where it is smelted, and where the metal is rolled into sheets or manufactured into other articles of commerce.

The following brief statement furnished by the Company tells us how successfully a mining venture may sometimes turn out. "The company, which has a paid-up capital of £160,000, was formed in 1862, and since that date has imported 236,058 tons of copper ore, representing about 70,000 tons of fine copper, which has realized £4,680,000." The dividends paid have amounted to £1,215,625, or more than seven times the original capital; with the drop in the price of copper the dividends have naturally fallen off, but the profit in 1885 amounted to no less than £47,500.

The Namaqua Copper Company, whose mines adjoin those just referred to, showed rich bornite and chalcopyrite, and photographs of King's magnetic separator, which is regularly used for extracting magnetite from the ore, and so raising the percentage in copper.

Diamonds.—Apart from any considerations concerning the beauty and value of the gems, there was nothing in the Exhibition more interesting to the geologist and the miner than the specimens, maps, models and working machinery which explained how diamonds occur in the earth and how they are extracted from their matrix.

The exhibits of the Kimberley Local Committee in particular were most complete, and while fully explaining every necessary detail, contained nothing superfluous; this is a proof of much care and forethought on the part of those who undertook to send a representative collection to England, under the charge of Mr. F. Schute, F.G.S., lately Government Inspector of Machinery at the Diamond Mines.

Turning in the first place to the large map of the Colony, we saw the Kimberley district lying south of the Vaal River to the west of the Orange Free State. A well executed map, on a scale of 1 inch to 10 chains, sent by the London and South African Exploration Company, Limited, next explained that the four principal mines, Kimberley, De Beer's, Dutoitspan and Bultfontein, all lie within a circle with a diameter of 3 miles; and then four admirable large sectional drawings by Mr. K. Tucker and W. C. Davies, together with plans and supplementary geological sections by Mr. Schute, enabled us to study the special features of each particular mine. On the next page I have arranged in the form of a concise table the statistics supplied by Mr. Schute.

The diamond-bearing rock occurs in the form of vertical masses, round, oval or irregular in horizontal section, enclosed by shale and carbonaceous shale, or thick sheets of basalt and amygdaloidal dolerite, lying flat or nearly so.

The upper part of the diamondiferous "pipes," or "erect masses," has always been a soft yellow friable ground for a depth varying from 45 feet at Bultfontein to 60 feet at the other three mines; then comes "soft blue ground," 31 feet thick at Bultfontein, and finally the "hard blue ground," the only rock which is now being excavated. The yellow ground is simply weathered "blue," or "blue" altered by atmospheric agencies, like the "gossan" of a mineral vein. The enclosing works have undergone a similar change, yellow shale at the top passing into black shale at greater depths.

The "blue ground" is a breccia containing angular lumps of shale, sandstone and dolerite, and particles of mica, iron pyrites and other minerals in a greenish cement. This greenish cement is a hydrous silicate of magnesia, and is supposed to be a decomposed eruptive volcanic rock. In fact the diamond-bearing masses are considered to be the throats of old volcanoes,

greatly altered, it is true, by the subsequent action of water. Charred fragments of trees are found in the hard "blue ground," and as carbonaceous shales are traversed, an ample supply of carbon was present for the formation of diamonds, as suggested in 1881 by Mr. E. J. Dunn.

Having obtained an idea of the mode of occurrence from the plan and sections, I may now turn to the models which explain the old methods of working in the early days and the improved system now adopted.

	Kimberley.	De Beer's.	Dutoitspan.	Bultfontein.
Total number of claims in the mine, 1886	346	592	1,411	810
Size of each claim	31 ft. sq.	31 ft. sq.	30 ft. sq.	30 ft. sq.
Approximate area* of the diamond-bearing rock at the present time	7⅛ acres	13 acres.	29 acres	16¾ acres
Approximate number of claims worked, open and underground, in 1885	196	340	1,100	308
Approximate average depth worked out in 1885	25 ft.	20 ft.	27 ft.	45 ft.
Greatest depth attained in open workings	420 ft.	370 ft.	290 ft.	308 ft.
Greatest depth attained in underground workings	600 ft. †	500 ft.	500 ft.	no underground workings
Average yield of the blue ground per load of 16 cubic feet ‡ washed in 1885	1½ carat §	½ to 1½ carat	½ carat	½ carat
Weight of diamonds produced during 1885	524,000 carats §	567,000 carats	560,000 carats	636,000 carats
Value of the diamonds produced during 1885	£460,000	£500,000	£690,000	£580,000

* The original areas of the diamond-bearing rock at the surface were: Kimberley, 9¼ acres; De Beer's, 3¼ acres; Dutoitspan, 30½ acres; Bultfontein, 20¾ acres.

† Mr. Schute informs me that an exploratory shaft was sunk, during the year 1886, to a depth of 800 ft. from the surface, in diamond-bearing ground.

‡ These 16 cubic feet of broken stuff are about equivalent to 9 cubic feet of solid ground.

§ As diamond merchants and jewellers whom I consulted differed in opinion as to the exact weight of the carat, I wrote to Mr. H. J. Chancy, Superintendent of the Standards Department of the Board of Trade for information on the subject, and he kindly allows me to quote his reply:—"The 'carat' is a weight unknown to the Law. No standard of it has ever been made or recognized. The 'carat' weight, like other customary weights, has continued to be handed down from one generation to another without the force or sanction of law. Under the Weights and Measures Act of 1878 its use is illegal, but the Act is systematically ignored, and the 'carat' weight continues to be everywhere used in the sale of diamonds and other precious stones. Its exact weight cannot therefore be stated.

"Its customary weight in this country is 3·16994 grains troy or avoirdupois, or 205·409 milligrammes. At the Cape, as also in India, the English diamond carat is largely referred to, but the Dutch carat is also referred to. Authorities differ as to the weight of the Amsterdam or Dutch diamond carat, but it may be taken as 205·70 milligrammes."

I think it is greatly to be regretted that the buying and selling of diamonds, a trade involving very large sums of money, should be conducted with irregular and illegal weights.

Thus in 1873, when no person could own more than two claims, and when the big open pit was not more than 100 feet deep, the stuff was raised in buckets, suspended by pulleys moving on fixed carrying ropes, and hauled up by ropes worked by windlasses, or by endless ropes passing over drums, hand labour only being employed. Owing to want of space round the top, the sets of hauling-gear had to be arranged in tiers one above the other.

Horse whims drawing up tubs holding 3 cubic feet began in 1874 to replace hand labour, and they in their turn were gradually ousted after 1877

by steam engines. Two plans, known as "tub gear" and "sling gear," are in vogue nowadays. In either case two strong parallel pairs of wire ropes are stretched from a framework at the surface to the bottom of the pit, and form an aerial double-acting inclined railway, upon which run carriers with four grooved wheels. These are hauled up or lowered by means of a wire rope, on a coiled drum worked by a steam engine. The tub is a cylindrical iron vessel, supported on the carrier by trunnions and is tipped either automatically or by a labourer. With the sling gear a cage, hanging from a similar carrier, receives the truck at the bottom of the pit and is then hauled to the surface.

The excellent model of the Bultfontein mine, on a scale of $\frac{1}{8}$ inch to 1 foot, enabled us to form an idea of the huge circular pit, 1100 feet in diameter at the top and 308 feet deep, formed by the removal of 7,000,000 cubic yards of ground, which have yielded approximately £5,000,000 worth of diamonds. Seventeen aerial tramways bring the stuff up to the surface. It was to be noticed that the bottom is not flat, but is divided into square and rectangular blocks with perpendicular sides, some deeper than the others, because all the companies do not work down their claims at the same rate.

In the beginning the sorting was done dry. The diamond-bearing earth was sifted dry and picked over in that state; but in 1874 the cradle ripple washi ngmachine was introduced. The model exhibited shows that it was somewhat different from the gold digger's cradle. The stuff was raked upon an inclined table, under a stream of water, and then flowed into the cradle proper, a trough with a curved bottom and five cross partitions of boards. The frame supporting the cradle stood upon rockers, enabling it to be moved to and fro, and so causing the mud and fine particles to be carried away in the current, leaving clean gravel which could easily be picked.

In 1875 the rotary washer was introduced, and the work is done more expeditiously and cheaply; but as the blue ground which is now being raised is hard and compact at first, it has to be allowed to disintegrate naturally under the influence of the weather before it is ready for washing. The Bultfontein model showed part of the depositing floors. The whole process is well summed up in the little descriptive pamphlet issued by the French and D'Esterre Diamond Mining Company: "The ground is blasted and quarried in the mine, and is hauled out of the mine in lumps of various sizes up to about 1 cubic foot. It is then conveyed on tramways to drying floors, deposited and spread out. After being left for a considerable time, it is broken by means of picks into pieces not larger than four cubic inches, and is again left to dry for a further period (until most of the natural moisture has evaporated); water is then applied, which results in still further disintegration. It is then rolled and harrowed until it becomes thoroughly pulverized and ready for the rotary machines.

"The entire process usually occupies from four to six months, the time taken depending materially on atmospheric conditions; and it is hence obvious that it is absolutely necessary to have a 'stock of blue on the floors,' in order to carry on the working operations without intermission."

The stuff is known at first as "coarse blue ground," then as "broken blue ground," and finally, after the rolling, as "pulverized blue ground." The pulverized blue is loaded into trucks and conveyed by a locomotive to the washing establishment. Two complete models showed us the washing gear:

one, on a scale of ½ inch to 1 foot, represented the works of the Bultfontein Mining Company; and the other, on a scale of 1 inch to 1 foot, the machinery employed by the Griqualand West Diamond Mining Company at Dutoitspan.

At Bultfontein a steam hoist raises the "pulverized blue," which is tipped into a shoot leading to a revolving screen, with holes 1 inch by 1 inch, or 1 inch by 1½ inch, supplied with a stream of water. The coarse stuff rejected by the screen is deposited close by and allowed to weather more completely, whilst the finer stuff runs into one of the rotary washers. These correspond to the puddling machines used for auriferous wash-dirt, the object being to free the stuff from the finest sand and mud, and leave a clean gravel in which the diamonds are distinctly visible. A rotary washer is an annular iron pan 8 to 15 feet in diameter and 16 inches to 2 feet deep externally, whilst the inner rim, 4 feet in diameter, is only 6 inches deep. In the centre is a revolving vertical shaft carrying eight radial arms provided with vertical blades, which dip into the mud and stir it up as they revolve. The stuff is fed in at the circumference by a shoot from the screen, and the muddy water escapes over the top of the low inner rim, and flowing into a tank, is raised in tubs by a wire-rope incline and tipped on to a fine screen. The sand rejected by the screen is allowed to run over and form a huge heap of refuse tailings, while the water that goes through is returned to the revolving screens.

The clean gravel is drawn off from the bottom of the rotary washer by removing a sliding-door, and is then sifted into various sizes in a pulsator containing a succession of sieves, each one finer than the one above it. This machine is a rectangular tank about 2 feet 6 inches long by 18 inches wide, in which are arranged three or more sieves, one above the other, each one finer than the one above it. The stuff is spread out on the top sieve, and water is pumped through, and the gravel is thus finally cleaned and separated into lots of uniform sizes, in order to facilitate the picking. The water escaping from the pulsator passes over a fine sieve which throws off any sand or stones that escape, and lets the water pass through, so that it may return to the pump and again be utilized in the pulsator. The sifted gravel is spread out on a table, and carefully picked over four times in succession, so as to prevent any diamond from escaping notice.

The Dutoitspan washing-gear is very similar, save that bucket elevators are used for raising the "pulverized blue" to the revolving screen, and for lifting the muddy water flowing away from the "rotaries."

The table of statistics furnished by Mr. Schute tells us that underground mining is carried on at Kimberley, De Beer's and Dutoitspan, in addition to the ordinary opencast working.

From Mr. Reunert's description, we learn that two methods are employed. One consists in removing the blue ground from below upwards, and filling the excavations with barren rock derived from the fallen sides of the open pit; whilst in the other, chambers 32 feet deep are first cut out under a solid roof of "blue," and then any overlying débris are cleared away, and the roof of the chambers and supporting pillars are worked away opencast.

The four mines just described are not the only ones in existence. Jagersfontein, in the Orange Free State, 80 miles South of Kimberley, produces £50,000 worth of diamonds yearly, and several other mines have

been started in British territory, but at present without much success. A plan and a section, both very neatly drawn, showed that a shaft has been sunk at St. Augustine's mine, near Kimberley, to a depth of 160 feet, and that various drivages have been made at the bottom. Unfortunately, very few diamonds have rewarded the enterprise of the shareholders.

The past of the four mines is summed up by Mr. Reunert as follows:—"By calculation of the amount of diamondiferous ground removed from each of the four mines to date, and from the known average yield per load in each, it is found that not less than 33 millions of carats * of diamonds (*or more than 6½ tons weight*) must have been extracted from the four mines up to the present time, realizing in round numbers 40 *millions sterling*."

As to the future, there is no sign of the "blue" becoming poorer; on the other hand, the sections show that the walls of the "pipes" are converging slightly, and that the area of the deposits diminishes with the depth. At Kimberley, however, one wall is diverging again, so it may be fairly hoped that the diamondiferous ground will not "cut out" altogether. At the same time, mining underground will be more costly than open quarrying, and as the ground will probably become harder, the disintegration by weathering will take longer time, and larger stocks will be required on the depositing floors.

The account of the South African diamond deposits would be incomplete if I did not allude to the exhibit of Messrs. Hill and Paddon, who showed diamonds from the river diggings, and the pebbles usually associated with them. It was in the recent gravel of the Vaal River that diamonds were first discovered in 1867, and in 1870 a large population had been attracted to the diggings. Though thrown into the shade by the discovery of the mines, the diggings are still worked by parties of men scattered along the banks of the river for a distance of 70 miles.

The Cape Commissioners are entitled to the greatest credit for erecting a full-sized rotary washer and working it. The washer supplied by Messrs. Davey, Paxman and Co. differed from the models by the feed being delivered by a series of revolving radial launders, but otherwise it was precisely similar, and the operations of washing the blue ground, sifting the gravel and picking out the diamonds, were carried on daily for two or three hours before a crowd of intently gazing watchers. No exhibit excited more general interest or more closely riveted the attention of the public than this actual process of diamond-washing on a large scale, and I repeat that the energy of the Commissioners is deserving of the utmost commendation.

In conclusion, I wish to point out that the South African diamond mines are interesting for more reasons than one. They teach us that the most precious of gems occurs in a manner undreamt of twenty years ago by geologists, and we marvel when we reflect upon the effect which the sharp eyes of the Bushman boy, who picked up the first recorded diamond, have had in enriching Cape Colony and Great Britain. It is satisfactory to note how the diggers have gradually overcome new difficulties in extracting diamonds, and though rude appliances were made use of at first and much money wasted, it must be borne in mind that British miners have no right to be too critical, because old-fashioned machinery and antiquated methods of working may still be seen at mines in Cornwall and Wales, within easy reach of all the resources of civilization.

* 6778 kilogrammes.

Salt.—A certain amount of salt is obtained every year from "pans" or shallow inland salt lakes, which become partially dried up in the hot season. There is a miscellaneous collection of samples from various pans. I presume that it is entirely used for local consumption, as the Cape imports large quantities of salt from Cheshire every year.

Stone.—The Paarl quarries, near Cape Town, supply good grey granite, of which a large block was exhibited, and fine- and coarse-grained sandstone, suitable for building, appears to be abundant in various parts of the Colony. The varied white and grey marble from Troe Troe, in the Clanwilliam division, takes a good polish.

Cape Colony may be specially congratulated on its excellent illustrated Official Handbook (Price 1*s.*), which contains an article by Mr. Theodore Reunert, M.Inst.M.E., on diamond-mining. It is the best general account of the mines hitherto published, and it is particularly welcome on account of its carefully prepared sections of the workings at Kimberley and De Beer's.

Useful notes concerning many of the exhibits are to be found in the Official Catalogue.

The output of minerals in Cape Colony in 1885 was:—

Kind of mineral.	Quantity.	Value.
		£
Coal	16,500 tons	12,375
Copper ore	20,213 ,,	395,675
Diamonds (*carats*)	2,287,000 carats*	2,230,000
Salt	365 ,,	506
Total Value . .	... ...	£2,638,556

* 463 kilogrammes.

NATAL.

Coal.—The coal of Natal is Triassic, but it must not be supposed that the rocks of this epoch, which according to Dr. Sutherland's valuable geological map occupy a very large part of the Colony, are everywhere coal-bearing. Mr. North's map, on a scale of 1 inch to 4 miles, represents workable coal as extending from Newcastle in the extreme north to a point some twenty miles east of Ladysmith, and the map compiled in the office of the Chief Resident Engineer of the Natal Government also shows the principal coal deposits as clustered in the neighbourhood of Newcastle and Dundee. Coal exists in other places, but workable seams have not hitherto been discovered.

The principal facts concerning the coal-field are summed up in the Catalogue as follows:—"The area of workable coal is for the present confined to the Klip River County, coloured grey on the large maps. The seams vary for the most part from 4 to 10 feet in thickness. Most of the samples afford good house coal. Some furnish good gas, and some are suitable for steam purposes. The area of the field available for working is 1350 square miles. Assuming an average thickness of four feet, and

allowing a deduction of 50 per cent. for faults, worthless coal and barren ground, this gives a fairly probable yield of 2,073,000,000 of tons."

These facts are based upon a comprehensive report made to the Natal Government in 1881 by Mr. F. W. North, F.G.S.

A large wooden model gave a full-sized representation of the largest seam yet discovered. It is 12 feet 9½ inches thick, with five partings of shale and sandstone amounting to 2 feet 1½ inches, leaving 10 feet 8 inches of available coal. Judging from the samples exhibited from various mines, the coal is not of first-class quality. Some of it evidently has a tendency to split up and crumble when kept, which is explained by the heavy percentage of iron pyrites revealed by analysis, and the amount of ash is frequently high. Nevertheless, as it is a question not of raising coal for export, but of supplying the necessities of the Colony, the coal-fields promise to render useful services to Natal, and indeed are already doing so. The seams lie flat and are easily worked, and the produce of the mines is being regularly used in the locomotives on the journey from the present inland terminus, Ladysmith, to Durban.

The advantages of using Natal coal are fully explained by Mr. North, who bases his conclusions upon actual experiments. When the railway is extended from Ladysmith into the coal-field, Natal coal will be delivered to the locomotives at 12*s.* 6*d.* per ton, whilst the average cost of English coal delivered into railway trucks at the coast terminus at Durban is £3 per ton. Experiments are detailed by Mr. North which show that the average consumption, with similar loads on similar gradients, is about 26 lbs. of English coal against 33 lbs. of Natal coal, or roughly speaking 1¼ ton of the latter is required to do the work of 1 ton of the former. Therefore, though weight for weight English coal does more work, the advantage, when we take into consideration the question of cost, lies very decidedly with the Colonial product. We may regret that the collieries of Great Britain will lose a customer, but the loss in its coal trade will probably be more than compensated by traffic in other goods, due to the increased prosperity and development of Natal.

Gold.—The rich and interesting specimens of gold quartz exhibited in the Natal Court were not really the produce of the Colony; they came from the gold-fields of the eastern part of the Transvaal, which are now attracting much public attention, and they found a place among the Natal exhibits because the working of the mines has been largely due to the energy of former dwellers in the British possessions.

Moodie's Gold Mining and Exploration Company sent auriferous quartz from various reefs near the new town of Barberton. These reefs, some of which, according to Mr. W. H. Penning,* F.G.S., are stratified beds and not fissure veins, vary in thickness from 4 or 5 inches to 2 feet 6 inches, but the quartz is rich, producing from 1 to 5 ounces per ton. The quartz is generally rusty, some is cellular, containing casts of pyrites, and many samples show spots and stains of malachite and chessylite. In some of the large blocks and in numerous picked specimens the gold is plainly visible. Practical crushings are of course the most satisfactory test of the value of gold reefs, and when we learn that 2875 tons of quartz yielded 5369 ounces of gold, or 1 oz. 17 dwts. to the ton, the most sceptical will be convinced of the richness of the mines.

* *Quart. Jour. Geol. Soc.*, vol. xli. 1885, p. 572.

Barrett's Berlin Gold Mining Company sent a model of their 30-stamp mill supplied by the Sandycroft Foundry, as well as samples of the quartz.

The increase in the exports of gold may be taken as a criterion of the success attending mining operations in the South African Republic. The exports through Natal alone were :—

	ozs.
1884	16,708
1885	52,222
First three months of 1886	22,433

Gold-mining therefore appears to be established on a firm footing, and the immigration of a large British population into the Transvaal in every way bodes well for the future of South Africa.

Iron.—Soft red hæmatite has been found in the coal-field, and analyses prove it to be a good ore for smelting ; other ores occur, and possibly some day they will be utilized for making iron in the Colony.

Ochre.—Judging by the number of samples exhibited, natural ochres of various shades of red, brown and yellow are abundant. Some of the specimens were coarse and poor, but others, such, for instance, as those of Mr. C. Willson, were good, and simply require levigation to produce useful pigments.

Plumbago.—The samples of plumbago sent by Mr. W. Kenrick would be more properly described as a plumbaginous clay, as the sample which I had analysed contained only 19 per cent. of carbon, and cannot be compared with the Ceylon or Canadian graphite in point of purity.

Stone.—The collection of stones included granite, gneiss, varieties of sandstone and blocks of the white Umzinkulu marble, which, though existing in immense quantities, cannot be utilized commercially until the cost of transport is cheapened.

The Natal Official Handbook (Price 3*d.*) contains a chapter on the Coal and Minerals of the Colony and a map showing the extent of the Klip River County Coal-field ; the Catalogue of the Natal Contributions (Price 3*d.*), in speaking of the Barberton gold mines, gives the thickness and probable yield of some of the reefs.

Full details concerning the coal of Natal are found in Mr. F. W. North's "Report upon the Coal-fields of Klip River, Weenen, Umvoti and Victoria Counties," London, 1881.

CEYLON.

Mining in Ceylon is confined to the extraction of gems and plumbago.

Gems.—The peculiarities of the various gems will be dealt with by Mr. Gregory in his report, and, as far as digging proper is concerned, it is only necessary to say that it is of the simplest description. The pits are shallow, rarely more than 20 or 25 feet deep. A section exhibited shows that at a certain gem pit, 18 feet deep, the strata passed through were : Field-mud, sand and vegetable matter, potter's clay, and finally gem-bearing gravel. This is washed either in round baskets, or in long wooden troughs

with gratings of perforated zinc, which separate the gravel into stones of various sizes. The washed gravel thus freed from sand and mud is thrown upon a table and the gems are picked out; however, it is found that a very small proportion of these are worth cutting. Well-filled cases showed that Ceylon produces a great variety of beautiful gems in addition to its rubies and sapphires.

Plumbago.—The extraction of plumbago and its preparation for the market were illustrated by photographs and specimens.

One of the photographs sent by Messrs. Morgan Bros. of the Crucible Company, Battersea, represented part of Dermatagolla plumbago mine, eighteen miles from Kurunegala, the capital of the North-Western Province. The graphite occurs in an almost perpendicular vein, many feet in width, which has been worked quite open for a considerable depth, leaving a huge chasm. The mine is stated to be 450 feet deep, and doubtless the lower workings are carried on by shafts and levels, as is the case at some of the other mines.

Even Mr. Ferguson's useful pamphlet affords little first-hand information about the mining itself, which is entirely in the hands of Sinhalese; but we learn that the graphite is broken out by crowbars or blasting, and is drawn to the surface by hand or steam winches, which are also used for raising the water. The Dermatagolla photograph showed the water being carried up a rude ladder in pots by the miners, as a mishap had happened to the steam crane.

After a preliminary picking at the mine the graphite is despatched to Colombo to undergo the processes of cobbing, picking, and screening, which are explained by photographs and models. Men and women, using a tool something like a little axe, chop off any waste material from the lumps, and sift the fragments upon slightly inclined screens made of perforated sheet iron. They also clean the lumps by brushes made of cocoa-nut husks. In this manner four different kinds of graphite are produced, as shown by the excellent samples of Mr. W. A. Fernando, Mr. J. De Mel, Mr. A. T. Fernando and Mr. W. Gunasekara, viz.: "large lumps," pieces as big as the fist or larger; "ordinary lumps," about the size of walnuts; "chips," about the size of grains of wheat; and "dust," which includes everything smaller. The graphite is now ready to be barrelled for export.

In addition to the ordinary trade samples I must mention two huge blocks of pure graphite, which did not fail to strike the eye, even in the close proximity of brilliant gems: one, weighing 3½ cwts., was sent by Mr. W. A. Fernando; the other, weighing within 4 lbs. of 4 cwts., by Mr. A. T. Fernando. They are magnificent examples of the produce of the Ceylon mines. Pieces containing quartz and iron pyrites told us what are the commonest minerals associated with graphite which have to be separated by the cobbing axe; but I could find no specimens of the enclosing rocks, though I learn from Mr. Ferguson's pamphlet that they are gneiss and mica-schist.

A small case sent by Messrs. Morgan Bros. showed some of the uses to which plumbago is applied, viz., the manufacture of pencils, stove-polish, and their justly celebrated crucibles. The exhibits included, lastly, some animals carved out of solid plumbago; but though these are well executed, it would have been better for the information of the mining world if the skill of one of the sculptors had been devoted to modelling an actual mine.

It is to be regretted that we have no detailed account of the graphite pits from a qualified European geologist or mining engineer.

The quantity exported in 1885 was 9861 tons. "The yearly value of the plumbago exports now varies from 1½ to 2½ millions of rupees, according to the extent of the trade and current value in the market." (Illustrated Handbook and Catalogue for Ceylon, p. 3.)

Stone.—A block of laterite or "cabook" was interesting from its curious appearance and from its being the most useful building stone in the Colony. It is a spotted reddish stone with dark ferruginous veins, and according to the Official Handbook it is considered to be a weathered and decomposed part of the gneiss which underlies it. It is easily cut, and it hardens on exposure. The Mahara gneiss was used in making blocks of concrete for the construction of Colombo Breakwater. In the northern part of the island, houses are built of white coral rock, which is also burnt for making lime. Sandstone and red granite complete the list of building stones.

The Illustrated Official Handbook and Catalogue (Price 6*d.*) contains useful articles upon the building stones, gems and plumbago; and the subject of plumbago is treated at great length in a pamphlet by Mr. A. M. Ferguson, C.M.G., which is full of interesting facts and statistics. It is a reprint of a paper read by him last year before the Ceylon Branch of the Royal Asiatic Society.

MAURITIUS.

Two dressed blocks of finely vesicular grey basalt, and a specimen of a porous coral limestone, used as building stone, were the only mineral exhibits from Mauritius.

STRAITS SETTLEMENTS.

The Government of Perak, a Malay State under British Protection, sent a collection of specimens and tools to explain how tin ore is dug and washed. At present none but alluvial ore is worked; the deposit of stanniferous sand varies in thickness from 18 inches to 10 feet, and is covered by 6 to 30 feet of overburden. This is stripped off by Chinamen using a hoe, with the blade set at an acute angle to the handle, and the stuff is carried out of the pits in bamboo baskets by means of a yoke. The tin ground is dug out and brought up in the same way, and then subjected to a first washing in long wooden troughs; the rich concentrate is finally cleaned in a round wooden dish about 2 feet in diameter and 2 inches deep in the middle—a *batea*, in fact, to use the Spanish name. The clean tin ore is sold to the smelters.

The wash-dirt contains on an average 1 to 2 per cent. of tin ore.

The water in the pits is raised by endless chain pumps worked by over-

shot water-wheels, though some of the larger mines employ centrifugal pumps driven by steam-power.

With the aid of the specimens of tools exhibited, and with a little knowledge of the working of alluvial deposits, one could readily form a very fair mental picture of the Perak tin diggings.

The total quantity raised in Perak in 1884 was 10,190 tons, valued at 3,640,924 dols., independently of what was obtained in other parts of the Straits Settlements. A little fine gold is washed out of the tin sand.

The pamphlet entitled "Notes on the Straits Settlements and Malay States" (Price 3*d.*) has many pages devoted specially to Perak and its mines.

HONG KONG.

This Colony possesses no mines; but it exhibited cubes of coarse- and fine-grained granite of various colours. One block of stone was very cleverly and curiously carved by members of the Stonemasons' Guild of Hong Kong. A bottle of Hong Kong sand seemed at first sight of small importance, but its use and value were understood on turning to the exhibits of the Hong Kong and Macao Glass Manufacturing Co., Limited.

BRITISH NORTH BORNEO.

Coal.—No coal from Labuan was sent to the Exhibition, but the British North Borneo Company showed by two samples that our new Colony and the neighbouring territory also possess stores of fossil fuel.

One sample came from Batu-Batu on the coast of Borneo, some twenty-five miles S.S.E. of Labuan, and is said to be derived from a thick seam of excellent quality. It has not yet been worked.

The second sample, a large block, was from the Moaro, or Muara, mines on the coast, some twenty miles S.S.W. of Labuan. There are three seams, respectively 25, 24, and 16 feet thick, which have hitherto been worked on a small scale, for at the end of last year only 800 tons a month were being raised.

The coal is remarkable for being singularly free from ash, as will be seen by consulting the two following analyses of Muara coal by Mr. Robert R. Tatlock:—

	No. 1 seam.	No. 2 seam.
Volatile matter—gas, tar, &c.	39·80	38·00
Fixed carbon	49·06	50·20
Ash	00·84	1·20
Moisture	10·30	10·60
	100·00	100·00

Practical trials on ships have proved it to be a good steam coal, though requiring somewhat more storage space than an equal weight of Welsh coal. We need not therefore be afraid of any lack of coal for shipping in the East.

Gold.—This metal has lately been discovered on the Segame River in the East Coast Residency, and the banks of the river are said to be gold-yielding for 120 miles along its course. A couple of hundred Chinamen and Malays are already at the diggings; the gold hitherto obtained is fine, the largest nugget being no bigger than a bean, and all is being got by means of the *batea* or wooden bowl. But no doubt Chinamen who have been in Australia, New Zealand, or California will introduce appliances for treating the wash-dirt more cheaply and expeditiously.

The Handbook of British North Borneo (Price 1*s.*) contains a valuable map and much information concerning this young but not unimportant Colony.

BRITISH GUIANA.

One small bar of gold denoted the existence of alluvial diggings on the Cuyuni River, but the importance of the gold-fields must not be measured by the size of the exhibit. From personal observation I can testify to the richness of the auriferous country on the banks of the Cuyuni in the neighbouring state of Venezuelan Guyana, with its famous Callao and other mines, and the British Territory deserves serious exploration.

WEST INDIES.

Trinidad.—The Pitch Lake has long been known as a natural wonder, but its utilization has been a matter of comparatively recent date, and even now the yearly output is not so large as it might be. The general aspect of the lake is faithfully depicted in some sketches made in 1851 for Admiral the Earl of Dundonald, who was the first person to realize the full value of the deposit, the nature of which was explained by various samples. These included glance pitch, crude pitch as it is dug from the lake, and purified asphalt in blocks of about 1 cubic foot, as it is exported to America and Europe for making pavements. The purified asphalt is made by melting the crude pitch in iron pans, and allowing the greater part of the earthy matters to settle down; the purified product is then ladled out into moulds. The output in 1885 was 28,505 tons of raw pitch, worth £28,505, and 6731 tons of purified asphalt, worth £13,456; three-fourths of it went to the United States.

The glance pitch is the pure mineral practically free from ash, which is used for making a varnish.

Finally, I noticed lumps of gypsum and plaster of Paris manufactured from it.

Barbados.—The island contains a large deposit of infusorial earth, and produces also some bright, pitchy-looking coal; but the specimens were unaccompanied by any notes concerning the quantity that is available. Crude petroleum, such as was exhibited, is stated to be abundant.

Coral serves for making lime, and a porous limestone, the so-called "drip-stone," is cut into gigantic bowls which serve as natural filters; a similar rock supplies a common building-stone.

The sample of phosphate earth unfortunately represented a small deposit which cannot rival or approach the store that exists on the island of Sombrero, whose produce is imported into Barbados for making artificial manure.

In the case containing the samples of manure, there was an interesting specimen from the Dutch island of Aruba, sent by Mr. George Hughes, showing the conversion of coral into phosphate of lime by the percolation of water containing phosphoric acid derived from the dung of sea-fowl.

Leeward Islands.—The volcanic origin of several of these islands was indicated by the products of active "solfatare." Dominica sent native sulphur and native alum, Montserrat native sulphur and sulphate of alumina, and St. Kitts native sulphur. Puzzuolana can be obtained at many of the islands for making mortar. Though the island of Sombrero is not mentioned in the Official Catalogue, the small exhibit of its phosphate of lime must not be passed over. Messrs. Pickford and Winkfield inform me that, since working began in 1857, about 250,000 tons of phosphate of lime have been produced, worth more than a million sterling. The output for 1886 is estimated at 6000 tons.

British Honduras.—The specimens of quartz from this Colony did not appear to have been assayed, but they are stated to be auriferous.

Bahamas.—Salt has been largely produced by the natural evaporation of salt lakes on many of the islands, and good samples were sent from Inagua; but, according to Sir A. J. Adderley, it no longer pays to send salt to the United States, formerly excellent customers, owing to the imposition of high import duties by the American Government, and the unfortunate islanders will witness the extinction of one of their most important industries unless the prohibitive tariff is reduced.

The Handbook and Catalogue (Price 2*s.*) is stored with useful information about the West Indies and British Honduras, and in the part relating to Jamaica there is an interesting account of the tradition that gold exists in abundance.

GOLD COAST.

Gold nuggets and very auriferous quartz bore witness to the appropriateness of this Colony's name.

MALTA.

The only mineral exhibits from Malta were two varieties of building stone and ornamental stalagmite. Though differing very much in character, the soft and hard building stones are both limestones. According to partial analyses kindly made for me by Mr. George Siddle, of Jarrow-on-Tyne, the former contains 93·5 per cent., and the latter 95 per cent. of carbonate of lime. The soft stone is a finely oolitic rock of a creamy-yellowish colour, familiar to all visitors to Malta, as it is *the* building stone of the island. It is obtainable in large blocks, uniform in texture and in colour, and can be sculptured with great ease; it is a stone therefore that finds favour with architects, because they can get elaborate ornamentation at little cost. A handsome façade, 30 feet high and 50 feet wide, showed the general capabilities of the stone. Some of the balusters exhibited were amazingly cheap, and plain ones were quoted even as low as 6*d.* each, with cornices at the same price per foot. I also found highly sculptured vases ornamented with foliage, flowers, fruit and animals.

The stone is decidedly porous, and absorbs a good deal of water; the question therefore naturally arises whether the ornamental balustrades would stand the frosts of a British winter. According to Sir Victor Houlton, the Executive Commissioner, this question may be answered in the affirmative, for ornamental vases made of Malta stone have been exposed in the open air in England, winter and summer, for fifty years without suffering. Under these circumstances British architects will do well to study the question of employing Maltese stone, for the examples chosen by the Hon. E. L. Galizia showed what excellent work can be obtained at a small price.

The hard limestone is white, yellowish white, and reddish in colour, and is made up largely of particles of cleavable calc-spar. It takes a good polish, and serves in Malta for pavements.

Stalagmite is found in some of the limestone caves, and slices of it are used for making mosaic table tops.

The Catalogue of the Malta Court (Price 6*d.*) gives a list of prices of the stonework, and Dr. Zammit in his "Malta and its Industries" (Price 2*s.* 6*d.*), devotes a page to the mineral products.

CYPRUS.

Copper.—No one would imagine from the specimens of chrysocolla and copper-stained rocks that Cyprus had once been the scene of mining on an extensive scale. Old slag heaps remain to tell of its glory in Phœnician times, and remind us how the metal copper received its name, but the exhibits did not give much promise for the future.

Ochre and Umber.—Of more immediate importance is the umber which has been regularly dug from open pits for years. I learn from Mr. Hamilton

Lang that it is very abundant near Limasol and Larnaca. Some years ago over 5000 tons were exported annually, but the trade was nearly extinguished by the imposition of an export duty of 5*s.* a ton. This duty or royalty was excessively high on an article delivered f.o.b. at Larnaca for 16*s.* a ton. It has now been reduced to 3*s.* 6*d.* a ton, but the reduction will have to be still greater before the umber trade can flourish. Good light yellow and red ochre (*Cyprusite*) were shown, and their geological and mineralogical interest are explained by Mr. Julien Deby in the Journal of the Microscopical Society for 1883.

A certain amount of bay-salt is produced every year near Larnaca and Limasol; asbestos of long fibre, but dirty, was exhibited, and was said to come from localities which furnished the ancients with this mineral. The island also produces gypsum, which is quarried and burnt for local use.

The Handbook to Cyprus and Catalogue of the Exhibits (Price 3*d.*) contains analyses of Cyprusite.

General Summary.

I will now point out very briefly the principal lessons that may be learnt from the mineral exhibits of the Colonies.

1. The all-important mineral coal is very abundant, and the coal-fields are favourably situated for supplying shipping in the North Atlantic, as well as in the North and South Pacific Oceans.

2. Plentiful stores of good iron ore exist, which, though little utilized at present, will doubtless in the future become a source of wealth.

3. The gold-producing capabilities of Australia, New Zealand, and the Dominion of Canada are very great. It is true that the output of Australia has fallen off considerably of late years, owing mainly to the partial exhaustion of shallow alluvial diggings which could be worked by men without any capital; but "deep leads" and quartz reefs abound, and only await the advent of capital to yield up their treasures. Instances that I have taken care to quote show that the enormous sums asked by promoters of public companies, often mere wreckers of legitimate mining, are not necessarily required for the development and successful working of mineral properties.

4. Australia is richly endowed with tin ore in alluvial deposits and lodes. Even when the former have been exhausted, the latter, judging from our experience in Cornwall, may be fairly expected to retain their productiveness to the greatest depths hitherto reached in mining.

5. Silver, lead and copper are obtainable in various parts of our Colonial Dominions; some of the deposits are being successfully worked, whilst others only require improved means of communication to become remunerative.

6. We can provide the whole world with gems. Of the commoner minerals, such as antimony ore, asbestos, plumbago, phosphate of lime, there is no lack, to say nothing of the abundant supplies of stones for building and ornamental purposes.

7. Finally, when we reflect upon the new discoveries of minerals made within the last few years, and remember that large tracts of country have not been thoroughly prospected, or are still entirely unexplored, the thought naturally arises that unknown treasures will surprise us in the future as they have done in the past; but leaving these aside, it was evident from the splendid collections in the Exhibition that a prosperous future awaits very many of our Colonies as mineral-producing countries.

In conclusion, I desire to express my feelings of obligation to the various representatives of the Colonies, and especially to Sir Julius von Haast, Sir Saul Samuel, Mr. F. D. Adams, Mr. C. W. Willimott, Mr. F. Schute, and Mr. John McCarthy, for much kind assistance rendered to me while preparing my report.

MINERALS AND GEMS.

By J. Reynolds Gregory, Member of the Mineralogical Society of Great Britain and of the Société Minéralogique de France.

The authorities of the Colonial and Indian Exhibition are to be congratulated on the importance and value of its display of minerals, and on the great interest taken and energy shown by a numerous body of exhibitors who came forward to assist the various Colonial Commissioners in making this grand exhibit of the mineral resources of the different Colonies.

The admirable character of the collections of mineral products in the Exhibition renders it necessary to regard them under a different aspect from that under which they were formerly considered. We can now more fairly compare the mineral products of each Colony, and thus appreciate the comparative advantages of each. There is no doubt that the display was one of a most exhaustive character, and included, in most cases, admirable illustrations of the mineral resources and materials of the Colonies. Many of these are of the highest interest for industrial purposes, and the collection was so ample as to afford full opportunities for comparison.

As Dr. Le Neve Foster in writing upon the mining industries has to deal with ores and coal, our reports must necessarily overlap a little; but leaving in his hands the economic side of the question, I propose to pass in review nearly all the minerals exhibited, whether of commercial importance or not, and to dwell specially upon the gems with which some of our Colonies have been so richly endowed.

My report will deal with minerals from a scientific rather than from an economic point of view, except in the case of gems and minerals employed for ornamental purposes.

The mineral exhibits of the various Colonies will be brought under review in the same order as that of their arrangement in the Official Catalogue.

CANADA.

No British Colony made such an extensive and excellent display of its mineral resources as Canada. For variety of minerals of commercial value, as well as of great interest and rarity, the Canadian collection was unrivalled by that of any other Colony. The specimens were from official sources, displayed under the auspices of the Geological and Natural History Survey and of the different governments of the various provinces, under the direct control of Dr. A. R. C. Selwyn, C.M.G., F.R.S., Director of the Survey. In addition to these, many

private exhibitors contributed largely. Amongst them may be mentioned Mr. T. A. Keefer, Mr. W. A. Allan, Messrs. Oppenheimer Bros., Mr. F. W. Egan, and Mr. J. Lavington. An admirably compiled descriptive catalogue of the economic minerals of Canada that were exhibited, issued under the direction of Dr. Selwyn, is of the highest value and most instructive. The large and varied collection exhibited by Mr. T. A. Keefer was of much interest and value, and the number of different mineral species, as well as of specimens shown, indicated the perseverance of this gentleman in accumulating such illustrative specimens as he showed.

Amongst the gold specimens exhibited by the Dominion of Canada, of especial interest in a mineralogical point of view were characteristic pepites or rolled nuggets from the alluvial deposits. Some of these had the usual flat ovate forms so plentiful in most alluvial districts in all parts of the world. Examples were also shown of coarse flattish grains, chiefly from the Cariboo gold-field, and from other localities in British Columbia. Some of these are of a pale colour, owing to an admixture of silver. Some models or casts of specimens were also exhibited, showing large indistinct crystals from Mosquito Creek. A handsome specimen of reef gold in quartz was shown by Messrs. Oppenheimer Brothers, from Burn's Mountain, Cariboo. There was also quite a large series of specimens, some interesting to the mineralogist, but the greater part only of value as representing the produce of certain mining properties.

Specimens of platinum from the gold washings were exhibited by Mr. T. Elwyn, from Granite Creek, Similkameen River, British Columbia. The same metal is also said to occur in other streams, and grains of iridosmine occur with it. The mineral named Meneghinite, containing gold to the value of $16 to $20, and silver to the value of $8 to $12 per ton, was exhibited from Marmora, Ontario. Meneghinite is a mineral approaching grey copper or tetrahedrite in composition.

Of silver minerals the greatest variety of specimens was shown by Mr. Keefer. The collection included native silver, having the usual filiform character sometimes so fine as to resemble wool, so delicate are the filaments of the pure metal. Crystallized sulphide of silver or argentite was also exhibited; many of the specimens were massive, some pulverulent and some dendritic. Frequently the native silver and argentite are associated, and occasionally the native silver takes an arborescent form. The principal associates of the silver ores in the Thunder Bay and Port Arthur Districts, Lake Superior, are quartz, amethyst, calcite, fluor and yellow blende.

Dr. Powell, of Victoria, showed some small pepites of arquerite (silver amalgam) from Cassiar, British Columbia, where it is found associated with gold in the washings. A sample was also shown from Vital Creek by Mr. W. Wilson.

The copper minerals exhibited were mostly of interest to the miner and metallurgist rather than to the mineralogist, and were chiefly examples of ores that are valuable for smelting purposes, such as copper pyrites, native copper, bornite, or purple copper, and copper glance or chalcocite, of which latter a small specimen in brilliant crystals was shown by Mr. Keefer.

The iron minerals of Canada were represented by splendid masses of magnetite, some of which occasionally contain small octahedral crystals

of the same mineral, but are usually massive and blackish grey in colour, very similar to the Swedish and Norwegian iron ores. There were specimens of red hæmatite, occasionally of the mammillated and fibrous variety, but chiefly amorphous and compact, sometimes in crystalline granular masses of an iron-grey colour. Limonite, or brown hæmatite, occurs in lustrous stalactitic and mammillary forms, as well as fibrous and earthy in Londonderry, Nova Scotia; and ankerite, a highly ferruginous dolomite and abundant in the same locality, is largely employed as a flux in process of reduction of this ore. Examples of bog iron ore were also shown; this is an earthy variety of limonite. Spathic iron of a coarse crystalline character was also exhibited, as well as ilmenite or titaniferous iron, and specimens of iron pyrites, some containing a small percentage of cobalt. There were also specimens of limonite formed by the decomposition of iron pyrites, and a compact pyrrhotite, or magnetic iron pyrites. This mineral frequently contains nickel. Crystallized specimens of mispickel or arsenical pyrites from Marmora, containing gold, were also exhibited.

Massive examples of chromic iron, which are mostly found associated with serpentine, were exhibited from Canada, and from several other localities.

Iron ochres, both the red and yellow varieties, from Ottawa, were shown by the Geological Survey.

Lead was represented only by several specimens of a massive galena or sulphide of lead from several localities. Some of it is associated with calcite and it is mostly argentiferous, sometimes to the extent of 168 ozs. of silver per ton. Gold is also stated to be found in the galena from Kokesailah River, British Columbia, examples of which were shown by Mr. C. A. Vernon.

Zinc minerals do not seem to be largely developed in Canada, from the paucity of the specimens shown. Mr. Keefer exhibited a large block of rich black crystalline blende from the Zenith Zinc Mine, north shore of Lake Superior. The Geological Survey showed blende from Silver Lake, Thunder Bay, Ontario, in a calcite gangue, with galena, barite, and quartz.

Manganese was well represented by some good fibrous crystalline masses of pyrolusite of remarkably fine quality from Teny Cape, Hants Co., Nova Scotia, exhibited by the Nova Scotia Government. Specimens were also shown by Messrs. Churchill Bros. from Walton, Hants Co. Specimens of manganite from Amherst Island, Magdalen Sound, Quebec, said to contain 45 per cent. of manganese oxide, were shown by the Geological Survey; and Mr. Markham exhibited both pyrolusite and manganite from Markhamville, King's County, New Brunswick.

Antimony ores were also well represented by some admirable samples. Mr. B. M. Davidson exhibited from Rawdon, Hants County, Nova Scotia, a very massive and compact steel grained antimonite, somewhat laminated, which contains only a small amount of calcite and quartz. The produce of this mine was an average of 20 tons per week for the past year. Dr. James Reed showed specimens of antimonite from South Ham, Quebec, and antimonite with kermesite (red antimony), senarmontite and valentinite, also with native antimony. This deposit occurs in a gangue of quartz, with a little dolomite. The Geological Survey exhibited antimonite in quartz, &c., from Prince William, York County, New Brunswick; and the Brunswick

Antimony Company showed specimens of antimonite from the same locality.

Bismuth was represented by specimens of sulphide of bismuth (Bismuthinite) from Tudor, Ontario, exhibited by the Geological Survey.

Molybdenite, or sulphide of molybdenum, occurs in a vein of quartz having a lemon-yellow pulverulent crust of molybdic ochre; and specimens were shown by the Geological Survey from Ross, Ontario, and also from Jackfish Bay, Lake Superior, also accompanied by molybdic ochre.

Tellurium was exhibited in the form of sylvanite (telluride of gold and silver). This rare mineral was shown by Mr. Keefer, from the Huronian Mine, Thunder Bay. It is disseminated through the matrix, as in the Colorado specimens.

One of the most important and valuable minerals now obtained from Canada is apatite or phosphate of lime, which is largely employed in the manufacture of artificial manures, and is exported in immense quantities from Montreal. The supply of this is said to be almost inexhaustible. It is often found of a bright green colour, in a pinkish crystalline calcite or limestone. The mineral is massive, crystalline and also in detached crystals having a hexagonal form with a hexagonal pyramid frequently doubly terminated. The crystals vary from one inch long to the enormous one exhibited by Mr. W. R. Allan from the Emerald Mine, Buckingham, Quebec. This monster crystal is two feet high and two in its largest diameter, weighs 550 pounds, and is supposed to be the largest ever found in any country. Another fine crystal, 2 feet long by 8 inches in diameter, was exhibited by Mr. A. H. Taylor. Many other specimens were shown, including a very large mass of calcite, in which were imbedded fragments of enormous crystals of a fine green colour, the hexagonal sections of which were plainly visible.

Amongst the miscellaneous minerals exhibited was a fine specimen of mica-schist, with large crystals of garnet, from Skeena River, British Columbia, several large blocks of gypsum, and a pale tinted specimen of the fibrous variety of gypsum from Cape Blomidon, Nova Scotia, a large and fine specimen of green foliated talc, examples of chlorastrolite, rock crystal, fine smoky quartz, agates, and several very choice specimens of crystallized amethyst, notably a splendid one shown by Sir Charles Tupper. (Some of the crystals have a fine red colour from enclosed red oxide of iron; these are from Lake Superior.) There were also specimens of magnesite, massive and granular; also barite, both foliated and compact; a large fibrous mass of celestite from Bagot, Ontario, and specimens of mica and phlogopite in very large crystals from Burgess. Large specimens of chrysotile in some quantity were exhibited. This mineral, a fibrous variety of serpentine, is largely employed as asbestos, which is a distinct mineral. It is now worked to a considerable extent, and exported under the name of asbestos. Examples of it were exhibited, manufactured into various objects and appliances. There were also large garnet crystals from Wakefield, fine large grouped and single crystals of hornblende, as well as doubly terminated crystals of zircon from Renfrew, crystals of pyroxene or green augite, biotite crystals and wollastomite, orthoclase from Ross, Ontario, black sphene and scapolite from Sebastopol, Ontario, tremolite from Ross, green microcline from Hull, Quebec, and fine specimens of perthite and peristerite from Bathurst (these varieties of felspar are not found in any other locality),

labradorite, beryl from Berthier County, Quebec, and a number of large black sphene crystals, by Mr. W. A. Allan, also a good example of steatite from Potton, Quebec, by the Geological Survey.

A very interesting series of Laurentian and Huronian Rocks was exhibited by the Geological Survey of Canada from Ontario, Quebec, and Nova Scotia, from the Lake of the Woods to Cape Breton. It comprised 437 examples.

A beautiful series of specimens of the celebrated Eozöon Canadense was exhibited by the Geological Survey, including some most illustrative examples and sections of this problematical fossil, some of which were treated with solvents in order to develop more fully the structure of the supposed organism.

A series of coal plants from Cape Breton was also shown, in addition to a good collection of Silurian fossils exhibited by Messrs. F. W. and T. G. Stockwell.

NEW SOUTH WALES.

The mineral exhibits of the eldest of the Australian Colonies forwarded to England for the Commissioners, under the instructions of the Minister for Mines, well sustained the importance of this Colony as the chief mineral centre of Australia, and the admirable display of commercially valuable mining products, as well as the large variety of minerals of more scientific interest, though at present of less value, was of the highest importance. Great credit is due to Mr. T. G. Binny and his assistant Mr. Ford for their successful efforts in arranging and displaying the collection in such a satisfactory manner, so as to give a happy effect to the whole. The efforts of the well-known Department of Mines at Sydney, under the able head of the Under-Secretary for Mines, Mr. Harrie Wood, were singularly successful in producing such a display as amply illustrated the mineral resources of the Colony. The care also bestowed in the selection of examples by Mr. J. E. Carne, Curator of the Mining and Geological Museum, under the direction of Mr. C. S. Wilkinson, F.G.S., the Government Geologist, ought to be mentioned. The generally expressed satisfaction at the New South Wales exhibits of mineral products must prove of ultimate advantage to the Colony.

Among other important exhibits, Professor Liversidge, F.R.S. of the Sydney University, made a really scientific display of inestimable value as regards the mineralogy as well as the commercial products. This included many choice gems found in New South Wales, as well as the sands and detritus in which they are found. Another fine series of specimens was exhibited by Sir Saul Samuel, K.C.M.G., the Agent-General for New South Wales in London. Mr. Martin Isaacsohn, of Nundle, was likewise a large exhibitor of interesting specimens. Mineral products were also exhibited by various companies and by private individuals.

First in importance, and a prominent feature, was the upright case in the centre of the Court in which the Department of Mines exhibited some

remarkable specimens of gold quartz from the Mother Shipton Reef at Temora. This gold occurs in thin laminæ, filling the fissures of the quartz in all directions. A fine series of alluvial gold from twenty-five localities was also shown by the Department of Mines. Mr. Martin Isaacsohn exhibited a fine series of gold, including several pretty crystallized specimens from Bowling Alley Point, together with a good series of specimens of alluvial gold from Nundle and other localities. Some of the crystallized gold showed the cavernous hollow crystals common in some localities. Professor Liversidge also exhibited some choice specimens of gold in crystals in the not unfrequent lengthened and distorted forms, as well as examples of the dodecahedron, and alluvial gold from different localities. Some of the crystallized gold came from Gulgong, Orange Grafton, the moss gold from the mispickel at Lucknow. In addition to nuggets from Armidale and Bingera, many interesting mineral associates of gold were also shown by the same exhibitor, such as gold on metallic arsenic, in dolomite, on pyrites, in serpentine and with native copper.

Next in importance to gold were the silver specimens. The Department of Mines exhibited a valuable series of silver minerals. Remarkable returns have been obtained, some of the silver ores of the Night Dream Mine yielding 11,000 ozs. of silver per ton. Specimens of the chloride were exhibited, also embolite or chlorobromide of silver, an abundant ore in the rich silver mines of Chili, which appears to be a frequent associate of the ores of the Barrier ranges. A rich specimen of this embolite, weighing 25 lbs., from the Treasure Mine, Silverton, was exhibited by Messrs. Morris Brothers and Nolan, and a large block of the same kind of ore from the Uno Mine, Silverton. Professor Liversidge exhibited crystallized chloride of silver; this is always a rare mineral in crystals, which are quite soft like wax, and very similar to it in appearance.

The copper minerals exhibited by New South Wales showed the very varied examples which are always more or less associated. Naturally a large proportion are carbonates. There were some fine specimens of fibrous malachite from the Great Cobar Copper Mine, malachite with chessylite (the blue carbonate), and redruthite or copper glance. In Sir Saul Samuel's collection was a very fine specimen of fibrous malachite, cuprite (red oxide of copper), and redruthite from the Great Cobar Mine. Specimens were also exhibited of tenorite—a black oxide from Blayney.

The tin deposits of New South Wales are another source of great wealth to the Colony. Valuable lodes of tin-stone (cassiterite) are now worked, but a large proportion is obtained from the beds of streams as black sand. Many years ago thousands of tons were thrown aside as valueless after being separated from the gold, which was then worked from the alluvial deposits; this is the variety known as stream tin, and found as rounded pebbles, or as black or brown grains, usually associated with titanic iron, zircons, and other minerals. Among the specimens exhibited were various samples of the many forms of stream tin, including pebbles of considerable size. A fine display of various tin specimens was made by the Department of Mines, chiefly from New England; some of these were crystallized. Professor Liversidge showed some fine crystals of this mineral from Inverell.

Among the iron specimens from the Colony must be mentioned specimens of magnetite from Blayney, which is strongly attractable; some fine crystals of iron pyrites, shown by Mr. R. A. Watson; and bog-ore

variety of limonite from Mittagong, exhibited by the Department of Mines. Professor Liversidge exhibited a botryoidal form of limonite from Sunny Corner, and a specimen of vivianite or phosphate of iron, titaniferous iron from the river detritus, which is found associated with many gems, gold, &c., from Uralla and Berrima districts, and from other places, by Mr. Isaacsohn; there was also shown a pretty specimen of göthite from Capertree. Brown hæmatite was also exhibited from the Fitzroy Iron Mines, Mittagong.

Lead minerals, and especially galena, exist in many localities, but are generally worked for the silver they contain, in addition to the lead. Many of the galenas exhibited were termed silver ores. A specimen of native lead1 from Gundagai was exhibited by Professor Liversidge; galena, rich in silver, was also shown from the Gypsey Girl Mine, Barrier ranges; another was exhibited from Captain's Flat, Molonglo River, also an impure carbonate of lead, yielding 54 per cent. of lead, and 34 ozs. per ton of silver. Specimens of cerussite or carbonate of lead and a ferruginous carbonate of lead were exhibited from Silverton, Barrier ranges.

A fine display of antimonite, or sulphide of antimony, from New South Wales, was illustrative of another valuable mineral, and is found in many districts of the Colony. Associated with it are the yellow oxide, or cervantite, and some specimens of native antimony; large blocks were exhibited by the Department of Mines from Carangula, Macleay River. The department also exhibits cervantite from Cudgegong, and native antimony in auriferous calcite from the New Reform Gold Mine, Lucknow, as well as numerous other specimens.

The kerosene shale or bog-head coal is also an important mineral of New South Wales; it is very similar in appearance to our own Scottish mineral, and has the same dull, ligneous sound when struck, but is said to be richer in volatile hydrocarbons; a large number of blocks of this mineral were exhibited from Joadja Creek, near Berrima; Prof. Liversidge showed some specimens exhibiting conchoidal fracture, and a turned polished specimen in the form of an inkstand; other examples were shown from Mount York, Hartley, of a similar mineral.

Amongst miscellaneous minerals from New South Wales, Prof. Liversidge showed some honeycomb quartz, from Sunny Corner, which is in reality decomposed skeleton nodules of septaria, similar to those found in Durham in England. Asbestos specimens were shown by the Department of Mines from near Gundagai. Mr. Isaacsohn exhibited some beautiful specimens of rock-crystals from Bowling Alley Point; these were in remarkably fine groups. Prof. Liversidge exhibited plaster-casts of the Baratta or Deniliquin, and of the Bingera meteorites, also two fragments of the former stone.

Of manganese ores there were large specimens of psilomelane and wad from Glanmire, Bathurst district, exhibited by the Hon. John Sutherland, also others from Nundle and from Back Creek, near Rockley.

Zinc was represented only by zincblende, from Pye's Creek, which usually contains from 10 to 20 ozs. of silver per ton. Zinc minerals do not appear to be plentiful in New South Wales.

Cobalt ore was exhibited by the Carlos Gap Coal Mining and Smelting Company, and appeared only as asbolite containing cobalt, sometimes to the extent of 30 per cent. oxide of cobalt, and generally yielding about fifteen.

Cinnabar, or sulphide of mercury, seems to be only sparingly found in the Colony. It is disseminated in veins in the Devonian rocks at Kylestone, on the Cudgegong River, and also in the overlying tertiary drifts. Washed samples of the cinnabar were exhibited. Sir Saul Samuel also showed samples from Cudgegong. Native mercury is also said to occur in the Colony.

Arsenic was represented by specimens of mispickel (arsenical pyrites), exhibited by Mr. Isaacsohn, and by Prof. Liversidge, from Uncle Tom Mine, Lucknow.

Prof. Liversidge showed a specimen of osmiridium, in the usual form of scales or flattened plates, from the drifts of New South Wales, where it is usually associated with gold.

Tungstate of iron, or wolfram, is obtained from the Glen Innes and Vegetable Creek districts, in quartz reefs. The Department of Mines exhibited some specimens from Hogues Creek, county of Gough, New England, and Glen Innes. Tungstate of lime, or scheelite, has also been found associated with antimonite in the Eleonora Gold and Antimony Mine, near Armidale.

Examples of chromic iron were exhibited from Armidale, Upper Bingera. The Department of Mines also showed chromic iron, from the Tamworth Chrome Iron Company; and Mr. Isaacsohn some from Bowling Alley Point, Nundle. Two large blocks were shown by Messrs. Blackall and Hunt from Tamworth.

Bismuth was shown by the Department of Mines, also the carbonate and oxide of bismuth from Kingsgate, near Glen Innes. There were some specimens of sulphide in combination with the native metal, similar to those found in other parts of the world; native bismuth occurs also in the Vegetable Creek district.

Molybdenite, or sulphide of molybdenum, is found associated with the bismuth at Kingsgate, Glen Innes; and some very fine specimens were exhibited in large folia, which are in fact hexagonal crystals of this mineral.

The Department of Mines also exhibited specimens of steatite or soapstone, serpentine, magnesite from Kempsey and New England, calcite, gypsum, fluorspar, epsomite and dolomite.

Precious stones were admirably illustrated in New South Wales by the beautiful exhibits of Prof. Liversidge, the Department of Mines and Mr. Isaacsohn, of which that of Prof. Liversidge was the most complete and interesting. Naturally the first in importance is the diamond, of which a good display was shown; there were also many examples of the different diamond-bearing tertiary gravels from Bingera, Inverell, and Mittagong. The chief diamond deposits in New South Wales are at Mudgee and Bingera, where they are found under much the same conditions. The drift is composed of pebbles of jasper, agate, quartz, indurated slate, silicified wood, sandstone, and coarse sand more or less mixed with clay, of which examples were shown.

A valuable parcel of diamonds was received by the Commissioners at the Exhibition, from the Crown Jewel Mine, at Pine Ridge, Inverell, from the Woods, Moore, Knapton and Morrow's claim, and amongst them were many good and regular crystals, including beautiful rhombic dodecahedrons; many were of very fine quality, this being one of the finest parcels received from New South Wales. The colour of the diamonds varied from clear and transparent to various shades of straw-yellow, light-

brown, pale-green and blackish. Of all the crystalline forms of diamond found in the Colony, the octahedron appears to be the most uncommon, the more general being the rhombic dodecahedron, the macled octahedron, and the triakis—and hexakis—octahedron, but mostly elongated; other interesting specimens of diamond crystals were shown by Prof. Liversidge, and the various forms are described in detail by the exhibitor in the New South Wales Catalogue. Two of the largest and finest of the diamonds found in the Colony are the property of R. H. White, Esq., M.P., one of the members of the Commission in London. Both are beautifully cut and polished. They weigh respectively 3 and 3½ carats, and are mounted as rings. Crystals of diamonds were also exhibited by the Department of Mines from Bingera and Pine Ridge, Inverell.

Amongst other precious stones and minerals employed as gems, shown by the Department of Mines, were green beryl from Vegetable Creek, green sapphires, white and bluish topaz, garnets and zircons from New England, with sands containing gems from other localities. Prof. Liversidge also showed a fine series of these gem-sands, as well as many varieties of gems derived from them, rough as well as polished. Amongst his cut specimens were royal blue sapphires of the finest colour, green sapphires of great rarity, a colourless topaz of exquisite limpidity mounted as a pendant, and also a specimen in a ring. Another little known stone is the red zircon or hyacinth, of which there were several fine examples. This gem is found in no other locality of the size or quality of the New South Wales specimens, although Ceylon produces many other varieties of colour. Other stones uncut were the bluish topaz from Uralla, precious opal from Abercrombie River, and some specimens from Bulla, in Queensland, for comparison. Sir Saul Samuel and Mr. Isaacsohn also showed specimens of opal from Queensland.

New South Wales, through the Department of Mines, exhibited a well-arranged series of rock specimens, both of sedimentary and of igneous origin, as well as of the metamorphic series; also a collection of the characteristic fossils from the chief formations of the Colony, all arranged in systematic order

VICTORIA.

In the Victoria Court the most valuable mineral display consisted of the gold specimens, and the large series of models of the most celebrated gold nuggets, with the date of discovery, locality, weight, value, and many other details. The Department of Mines, through Mr. C. W. Langtree, the Secretary, was one of the chief exhibitors, some very interesting specimens being shown, both from the reefs and from the alluvial deposits. Many of the specimens shown by the Department of Mines illustrated the occurrence of the various associated minerals with the gold quartz, such as blende, arsenical pyrites, pyrites and galena, felspar and quartz, green carbonate of copper and native bismuth.

A very pretty display of gold quartz was made by Mr. Hansford,

the manager of the Queen's Birthday Gold Mining Company, at Dunolly. The Hon. D. C. Sterry showed some rich quartz from the Lady Barclay Gold Mining Company, Sandhurst, some of the gold being laminated. Messrs. Rowe Bros., of Fryerstown, showed the prettiest specimen of crystallized gold in milk-white quartz that was in the Exhibition; the crystals of this specimen are sharp and well defined, of exceeding brightness, and of a somewhat pale colour, due to the protective nature of the quartz cavity in which it is situated. Crystals found in alluvial deposits appear of a darker richer hue than those found in such cavities, but when reduced by smelting they are of the paler colour, though perfectly or very nearly pure gold, which it is probable this crystallized specimen is; the remaining specimens, exhibited by Messrs. Rowe, formed also a very attractive series. Mr. W. Campbell showed two of the earliest specimens found in the Colony. The Department of Mines exhibited examples of auriferous quartz as illustrating the great depths to which gold-mining is now carried. The Bank of Australasia made a fine display of alluvial gold and of large masses of retorted gold; amongst the former were bowls of gold in the form of nuggets and grains, to illustrate the amount of gold obtained in given periods from some of the washings: thus, one week's washing of Bell's Gold Mining Company, Creswick, yielded 132 ozs. 4 dwts.; and one day's production of the Madame Berry Gold Mining Company, Kingston, gave 116 ozs. 13 dwts.

These facts show the wonderful richness of the alluvial deposits in Victoria. A block of retorted gold from the Chiltern Valley Gold Mining Company, representing one week's crushing, contained 272 ozs. 7 dwts. Other specimens were a nugget from Ballarat, and a bowl of fine scaly alluvial gold, 33 ozs. 7 dwts. 18 grs., from the same locality; from Buckland there was a bowl of scaly alluvial gold, 82 ozs. 11 dwts., and one of flat pepites from Harrietville, 21 ozs. 2 dwts., &c.

Of silver minerals, the Department of Mines exhibited specimens from the St. Arnaud Mines, containing a considerable amount of gold, as well as a specimen of embolite or chlorobromide of silver. Examples of galena, containing silver, were exhibited from the Debet Mine, Buchan, containing 82 per cent. of lead, 30 ozs. of silver, and 1 oz. 5 dwts. of gold per ton; also from the Thirty-mile Creek, Dargo High Plains, containing 5 ozs. of silver to the ton; from Mountain Creek, Snowy River, 3 ozs. to the ton; from Corner Inlet, 4 ozs. to the ton; and an antimonial lead ore from Dargo River, 7 ozs. per ton, exhibited by the Department of Mines. Some zinc-blende, with iron pyrites, from Chrysolite Hill, St. Arnaud, contained 3·5 ozs. of silver per ton.

Lead ores, in the form of galena chiefly, are found at Percydale and in Gippsland; native lead has been found in the Haddon Deep Lead from gravel beneath basalt, and specimens were exhibited; galena was also shown from Fiddler's Reef, Avoca, with pyrites and quartz, and with calcite from Tarnagulla.

Stream tin appeared to be the only tin ore exhibited, and that mostly from the north-east part of the Colony, contiguous to New South Wales, and from some parts of Gippsland. The specimens came from the Upper Murray River, Beechworth, Mitta Mitta, Sandy Gully, Chittern and El Dorado. In appearance they were very similar to those from New South Wales.

Zinc-blende was shown from Western Reef, Chrysolite Hill, St. Arnaud, from Bethanga, and from New Chum Reef, Sandhurst.

Of copper minerals, copper pyrites was exhibited from Bethanga, and from the Walhalla Copper Mine, Thomson River, Gippsland; green and blue carbonate of copper, also from Bethanga, and from Lake Omeo; cuprite or red oxide of copper and melaconite, black oxide of copper, from Bethanga. Gold is frequently found associated with the copper ores in Victoria; native copper was shown from a quartz reef at Wilson's Hill, St. Arnaud.

The iron minerals exhibited included specimens of brown iron ore from Lal Lal, Beechworth. This deposit, according to Mr. F. M. Krausé, occurs partly in nodular and concretionary masses and partly in a tabular form, and in layers, and is supposed to be of comparatively recent origin. Iron pyrites was shown from various localities in crystals, of which some were in slate from Cattle's Reef, Fryerstown. The Ballarat School of Mines exhibited specimens of vivianite or phosphate of iron from the volcanic tuff at Wannan Falls, near Redruth; a brown iron ore with iridescent colours was shown from the Gellibrand River, Cape Otway district. The rare iron mineral, scorodite, was exhibited by the Department of Mines; it occurs in a vein in a metamorphic rock at Meade's claim, Strathbogie ranges, and contains gold. There were also specimens of pyrrhotite or magnetic iron pyrites from Maldon, and some specimens of titaniferous iron-sand.

Antimony was illustrated by specimens of antimonite or sulphide of antimony from Merton, Heathcote, Redcastle, Ringwood, Donovan's Creek, and from the Costerfield mines. The antimonite from Black Cloud Mine at Whroo contains gold to the extent of 1 oz. 2 dwts. to the ton; at Ringwood specimens of cervantite and valentinite, the yellow and white oxides, are found.

Specimens of molybdenite or sulphide of molybdenum were exhibited from Malden, Yackandandah and Beechworth.

Amongst miscellaneous minerals Mr. J. Hedley exhibited a block of chrome ochre with quartz from Talbot. The Department of Mines showed specimens of wolfram or tungstate of iron from Swift's Creek, Gippsland, and scheelite, tungstate of lime, wad (impure manganese oxide) from South Clunes, pyrolusite (grey manganese) from Tangil, and black oxide of manganese from the Shipton diggings. Amongst earthy minerals Mr. J. Hedley exhibited magnesite from Talbot and Heathcote, selwynite and the same associated with talcosite from Heathcote. From the basalt at Richmond, near Melbourne, were shown crystallized specimens of phacolite or seebachite, also of phillipsite, in large crystals for this mineral, analcite and aragonite. The Ballarat School of Mines exhibited a specimen of hydrocarbon named coorongite from Lake Coorong, South Australia. A fine specimen of infusorial earth was shown by Mr. Clarence Smith from Talbot. Specimens of kaolin were exhibited by the Department of Mines from Lal Lal, Beechworth and other localities. The School of Mines, Ballarat, and the Department of Mines showed some good quartz crystals, many of large size, also a transparent rock crystal coated with chlorite, and some specimens, from the Beechworth district, of chalcedony, enclosing water. Specimens of orthoclase and albite, tourmaline, fibrolite, olivine from Mount Franklin, opal and opalized wood, jasper, &c., were also

exhibited. Specimens of gem sands were shown from Daylesford, Blackwood, &c.

An extensive series of well-shaped rock specimens of considerable interest was exhibited by the Department of Mines, under instructions from the Hon. J. F. Levien, M.P., Minister of Mines, and Mr. C. W. Langtree, Secretary and Chief Mining Surveyor for the Colony. The collection included some exceedingly pretty granites and syenitic granites, phonolites, trachytes, quartz, and other porphyries, gabbro, syenite, felsite, melaphyre, diorite, basalt, in varieties as compact, amygdaloidal, and vesicular; also basalt tuffs, granulite, talcose, chlorite-, mica-, and chiastolite-schists, slates, sandstones, and other metamorphic rocks, as well as examples of the sedimentary series. There was also a large variety of fossils, including the well-known fossil fruit found in the gravels of the auriferous leads at El Dorado, near Beechworth, in the Ballarat district, and other places. This was described by Baron F. von Mueller in 1874.

A carefully compiled and descriptive catalogue of the rocks, minerals, and fossils, illustrative of the geology, mineralogy and mining resources of Victoria, was issued by the Victoria Government.

SOUTH AUSTRALIA.

South Australia was widely known in its earlier years for its wonderful deposits of copper and its celebrated Burra Burra and other copper mines. It is certain that South Australia is the principal copper-producing province in Australia, and an admirable display of the minerals and rocks was made by the Commissioners through Sir Samuel Davenport, K.C.M.G., Mr. T. C. Cloud, A.R.S.M., and by Mr. H. Y. L. Brown, Government Geologist, the Wallaroo Mining Company, the English and Australian Copper Company, and other exhibitors. The South Australian Commission had every reason to be well pleased with their mineral exhibits as displayed by the Executive Commissioners, Sir S. Davenport and by Mr. H. G. Scott.

Gold appears to be chiefly found in the Northern Territory, and is said to have been first discovered during the construction of the telegraph line. The gold seems chiefly to be worked from reefs. Showy specimens of gold quartz were exhibited from the Eleanor Reef and Pine Creek, as well as alluvial gold. The Adelaide Museum showed gold quartz in Mr. Cloud's collection. Mr. J. R. Tennant and the Hon. J. H. Parsons showed gold quartz. Gold has been found in kaolin, at Jupiter Creek and Little Bendigo.

Silver in South Australia is mostly associated with galena. An ore from the Aclaire Mine, 35 miles east of Adelaide, yields 302 ounces of silver and 3 ounces of gold per ton. Specimens of antimonial lead ore containing 224 ounces of silver to the ton, from the Aclaire Mine, were also shown. Argentiferous lead specimens were shown from Mary River, Northern Territory.

There were some galena specimens from Talisker and Avondale Mines containing silver. Other lead minerals, as cerussite and wulfenite, or

molybdate of lead, in reddish crystals, both from Avondale, were exhibited by Mr. Brown.

Copper was represented by a fine series of specimens of cuprite in dodecahedral and cubical crystals of great brilliancy from Moonta Mine, and by a fine mass of native copper from the same locality. There were also specimens of massive bornite and copper pyrites, as well as examples of covellite. The collection also included copper pyrites in crystals from Wallaroo Mine, fine crystallized and globular specimens of chessylite or azurite from the celebrated Burra Burra Mine, botryoidal malachite from the same, as well as chrysocolla, or silicate of copper, atacamite, in large and brilliant crystals, from New Cornwall Mine and Wallaroo. The copper mines of the Northern Territory are represented by specimens of copper glance, cuprite, malachite, and chrysocolla; and Mr. H. R. Hancock, on behalf of the proprietors of the Moonta Mines, showed other specimens of massive copper pyrites, native copper, and bornite. Mr. D. W. Scott exhibited copper pyrites and malachite from the Balara Mine.

Stream tin was exhibited from Mr. Cloud's collection. Crystallized cassiterite in granite from the Cruikshank and Barrett's claim.

Iron ore of a very massive kind was exhibited by Sir Samuel Davenport from Caroona, and is said to be plentiful. Red hæmatite was shown of the compact, hard, fibrous variety termed pencil ore; this specimen was broken to show its fibrous structure. There was micaceous iron glance from Angaston and other localities, crystals of martite in micaceous iron from Carey's Gully, Mount Lofty, and specimens of limonite from Hindmarsh Valley, near Mount Coffin, and other localities.

Psilomelane is the chief manganese mineral, and is shown from Gordon, near Quorn, by Mr. G. Prout, specimens of pyrolusite from Tintara, and of asbolite from Wooltana, by Mr. Brown.

Blende was the only zinc mineral exhibited. Some samples came from the Aclaire Mine, others were shown by Mr. F. C. Singleton, and by the Adelaide Museum.

Molybdenite in foliated plates from the Yelta Mine, Yorke's Peninsula, was shown by Mr. V. Lawrence, and also by Mr. J. B. Austin and Mr. R. Stuckey.

Bismuthinite, or sulphide of bismuth, in very fine specimens from Balhannah Mine, was exhibited by the Adelaide Museum, and by Mr. J. Phillips, who also showed bismuthite or bismuth carbonate.

Antimony was only represented by a poor specimen of ullmannite, with ankerite from Gill's Bluff.

Amongst miscellaneous non-metallic minerals were specimens of graphite or plumbago of fair quality from Port Lincoln; massive barite, crystals of selenite and fibrous gypsum, kaolin, from near Adelaide; crystals of beryl from Mount Crawford; olivine from Mount Gambier; margarite, talc, splendid large orthoclase crystals from Angaston, fine large quartz crystals, one with water cavities, opal, chalcedony, agates, calcite, aragonite, and ankerite. According to Mr. Cloud, Echunga is the only locality in South Australia in which the diamond has been found.

An exceedingly good and comprehensive series of rock specimens was exhibited by Mr. Brown; it included a number of examples of veinstones and reefs of the Mesozoic and Tertiary age, mostly highly metamorphosed; a fine series of granites, some containing schorl, quartz porphyries, gneiss,

mica schist, felsite, porphyrites, limestones, crystalline, as well as compact and quartzite, also some very interesting specimens of glacially-scratched dark red shales from Hallett's Cove, near Adelaide. Sir S. Davenport exhibited some very fine specimens of coarse conglomerates of red jasper, quartz pebbles, &c., from Coroona, west of Port Augusta; also a series of Mesozoic and Tertiary rocks, with pebbles of chalcedony and agate.

There was a fine series of fossils from the Palæozoic and Mesozoic formations from Lake Eyre district, and Mount Eba; Cretaceous plant remains and Tertiary fossils, mostly casts of shells from Crawford wells, Oolden and Androssan, Yorke's Peninsula, &c.

QUEENSLAND.

The Colony of Queensland made not only a very extensive display of mineral products, but one of a most interesting character, and admirably exhibited. There is also a prominent display of auriferous ores. An excellent and minutely descriptive catalogue of the mineral exhibits of this Colony, prepared by Mr. R. L. Jack, the Government geologist, and Mr. A. W. Clark, in which all the specimens are described in detail, is of extreme value to the student. Among the chief exhibitors were the Queensland Commissioners, Messrs. John Moffat and Co., the Herberton Local Committee, and the Stanthorpe Local Committee.

The various gold-fields were fully represented by some very interesting specimens, mostly from the reefs; the gold from the Palmer gold-fields is said to be the purest ever found in any part of the world, and to bring the highest value. Alluvial gold was formerly produced from this district, but the gold is now obtained from "reefs." Gold from the Ravenswood district is associated with pyrites, galena, blende, copper pyrites and mispickel. Some o ;the richest-looking specimens of gold quartz came from the Day Dawn Block and Wyndham Mine, and a large case of beautiful examples was exhibited by Mr. Thomas Mills. The gold is of a light colour, but the quartz seems full of it. A large block of retorted gold from this mine was exhibited by the Bank of Australasia. It weighed 1707 oz. 10 dwt., and was valued at £5923. At Mount Morgan the gold is found in limonite, a porous kind of bog iron. Some specimens of the limonite are stalactitic in character; the gold is here found very pure. A gold from the Canoona gold-field was named "black gold," from its being coated with oxides of iron and manganese. Blende containing gold is shown from the Niagara Falls claim, and an interesting specimen of gold associated with schorl was exhibited by the Union Gold Mining Co. Many other gold specimens were shown, but the above appear to be the most interesting mineralogically.

The silver minerals were not of special interest as minerals, and were mostly argentiferous galenas, some rich in silver. An earthy chloride of silver was shown from the Albion claim, sometimes yielding as much as 2314 ozs. per ton. Silver is also associated with limonite. A finely

granular galena, rich in silver, from Cumnor claim, is said to give 800 to 1400 ozs. per ton. These localities are all in the Tinaroo district. The Great Extended Silver Mining Co. exhibited a large specimen of rich argentiferous grey copper, said to give 2384 ozs. per ton.

Of tin a large series of specimens were exhibited, both lode and stream tin. On the Granite Creek stream tin occurs with gold, in Pinnacle Lease cassiterite is found with decomposing orthoclase, and at Return Creek, Coolgara, twin crystals of cassiterite are found. In the North Britain claim it is found with mispickel in quartz, as is frequent in the English Cornish mines. From the Herberton district was sent a specimen of cassiterite in elvan, also a fine series of stream tin from Stanthorpe district, and a fine crystallized cassiterite with quartz crystals from Mola Tableland.

Lead was represented chiefly by rich specimens of argentiferous galena, some having a granular texture, and much the appearance of the Sardinian specimens. From Kilkivan there was a massive compact cerussite with galena, similar to the Leadhill specimens from Scotland.

Copper minerals were illustrated by specimens of native copper, malachite, tetrahedrite, or grey copper, and melaconite, or black oxide of copper; also a rich massive cuprite, from the Cloncurry gold-field. Native copper was also shown from the Peak Downs Copper Mine. Mr. H. Salmon exhibited from this locality melaconite and malachite. A fine specimen of chessylite was shown from the North Australian claim, Herberton.

Of iron minerals the chief was a good bog ore variety of limonite from Mount Morgan district, some of which is beautifully iridescent, like specimens from the Isle of Elba. Few iron minerals were, however, exhibited.

Manganese ores were illustrated by large specimens of pyrolusite and psilomelane of remarkably good quality, which were exhibited by Mr. H. Friend, of Gladstone. Some large examples of psilomelane were shown from Gatecombe, also of very good quality.

Cinnabar, from the Kilkivan gold-field, was shown by Captain Eldred, of the Queensland Quicksilver Estates. The mercury obtained from it is employed locally in gold extraction, &c.

Antimonite in fine specimens was exhibited from the Emily Antimony Mine, Northcote. It is frequently coated with cervantite, and the antimonite from Craig's Lease and Minnie Moxham claims have gold as an associate.

Chrome was represented by very good examples of chromite by Mr. John Harris. Mr. J. Knox, of Brisbane, also showed chromite from the Serpentine rocks.

Bismuth, in the form of bismuthinite, was shown from Coolgara, and specimens containing gold from the Cloncurry gold-field.

Cobalt occurs in the form of asbolite at Mount Garnet in Herberton. Specimens of the mineral from the Kilkivan gold-field contained 22 per cent. of cobalt and 3·5 of nickel.

Arsenic was represented only by the arsenical pyrites, or mispickel from Kohinoor.

Wolfram is found in the Herberton district. Specimens from the Mackay district were exhibited by Mr. G. Francis.

Molybenite, from the Mackay district, was also shown by Mr. G. Francis.

Of miscellaneous minerals, calcite is found in many localities associated with gold. Specimens of magnesite were shown from Rockhampton. Graphite was exhibited from Stanthorpe, but of poor quality. Mr. Drain also showed graphite from the Mount Bouple Plumbago Mine near Maryborough, but this also was not of very good quality. Good crystals of orthoclase were exhibited from Stanthorpe; fine crystals of smoky quartz and a specimen of hyalite were also shown from Stanthorpe, as well as natrolite in amygdaloid and chalcedony.

Of precious stones the only variety shown from Queensland is the precious opal, of which a case of splendid specimens was exhibited by Mr. H. W. Bond, of Torrington Toowomba; many of the examples were of extreme beauty, quite rivalling those from Hungary in their rich play of colour, while the fine ultramarine blue colour, so finely shown in the Queensland specimens, is rare even in Hungary. Some specimens are of the rare kind, known as "Harlequin" opals; many of the stones are cut and polished as gems, and most of these are of high quality and of considerable size. No collection of opals has ever been exhibited in which such a variety of examples were displayed, with the view of showing the mode of occurrence of this unique gem. Many choice cabinet specimens showed the wonderful play of colour so peculiar to this stone. Some of the rough specimens appeared to enclose an apparent kernel of opal in a crust of a highly ferruginous jasper-like matrix; others appeared to indicate a vein of opal of rich colour; while some seemed to have the brilliantly-coloured patches and specks disseminated through the matrix. These specimens are of extreme interest to the mineralogist; the matrix appears to be highly charged with iron oxides, occasionally somewhat earthy, while sometimes it is quite siliceous, capable of taking a fine polish, and breaking with a conchoidal fracture. The locality where this stone is said to be found is near the Barcoo River. Some very choice specimens were mounted as a necklet, each stone being surrounded with diamonds. The specimens showing the finest play of colour appear to be those most recently found.

A considerable series of rock specimens was exhibited by the Queensland Commissioners, but these were mostly displayed with hand specimens from the various gold-fields as their "country" rocks, and not arranged separately as a petrological collection.

Mr. C. H. Hartmann showed some marsupial remains from Darling Downs, including part of a jaw of the nototherium, a tooth of the gigantic diprotodon, and various other extinct types; a variety of fossils from the upper carboniferous strata, and plants from the upper and lower jurassic beds from the Ipswich Coal Measures; also specimens of crioceras, ammonites, &c., from the Cretaceous beds, and some Tertiary fossils, &c.

WESTERN AUSTRALIA.

The Western Australian mineral exhibits were somewhat meagre, owing to the comparatively small amount of mining enterprise, and the con-

sequently undeveloped condition of the Colony's mineral resources at present. Quite lately, however—in fact since the opening of the Exhibition—proofs of the find of gold in the Colony came to hand from the new Kimberley gold-fields, and the prospects of a rush seem imminent. These reports are corroborated by the receipt of actual alluvial gold and nuggets.

The chief exhibitors were the Fremantle Museum of Mines and Minerals, through the Rev. C. G. Nicolay, Mr. E. T. Hardman, late Government Geologist, and now of the Geological Survey of Ireland, the Vasse Local Committee, and the Western Australian Committee.

A catalogue of the mineral, as well as other exhibits, was published by the Commission, and Mr. A. Thomson, the Assistant-Commissioner, had arranged the collections in a most satisfactory manner.

Amongst the specimens of gold recently received from the Kimberley gold-fields were some good examples of alluvial gold, some in rounded nuggets, as well as a nugget of 19 oz. 1 dwt. associated with a small quantity of quartz. Some of the gold is in flattened laminæ, and appears to be only slightly rounded, indicating the fact of its partial attrition. The first specimens were brought to Derby by Messrs. Hall and Slattery, who were the earliest prospectors for gold in the Kimberley District. On the second venture the same party with others obtained the 19-oz. nugget, and in all a total of 81 ozs. Mr. Hardman found reefs of a very promising-looking quartz, having visible gold in them. After this a nugget of 28 oz. 6 dwt. was received and exhibited; all these specimens were from the Ord River, Kimberley. Mr. Hardman exhibited iron-sand with gold, being the first washings. He says also that he has found gold on the Panton, Mary, and Margaret Rivers.

Copper was represented by specimens of copper pyrites from Wheal Margaret Mine, Northampton; chessylite, malachite, and cuprite, &c., from Wheal Fortune Mine, Northampton; also cuprite and malachite from the Badra Mine.

Of lead, in the form of galena, rich specimens were exhibited from Wheal Fortune, Champion Bay, and St. Geraldine Mine, Murchison River. Fine specimens were also shown by Mr. J. H. Gale, of Geraldton, from Badra Mine. Examples also came from Wheal Margaret Mine, Northampton; and large and well-crystallized specimens of galena from Wheal Fortune, Northampton, Champion Bay.

Iron seems abundant in Western Australia, and large blocks of limonite were exhibited by the Vasse Local Committee. These appear to be of the earthy bog-like variety, and come from the Vasse District. The York Local Committee exhibited blocks of hæmatite from Coates Hill, York Road. Specimens of magnetite, strongly magnetic, from the Fraser Range, were shown by the Albany Local Committee. Iron pyrites was shown from Wheal Margaret Mine, Northampton, and a specimen of meteoric iron, one of four masses found in 1883 at Yundagin, ninety miles east of York.

Zinc-blende was shown from Wheal Margaret Mine, Northampton.

The Albany Local Committee exhibited specimens of lignite of excellent quality from near Augusta, Albany.

Of non-metallic minerals there were specimens of gypsum, chalcedony, agate, rock crystal, actinolite, jasper, and stalactites, forwarded by the Rev.

C. G. Nicolay, who also sent a characteristic variety of the rocks of Western Australia, which were named and arranged by Mr. E. J. Hardman. These specimens belonged to the Museum of Mines and Minerals of Fremantle. A series of rocks collected in Kimberley, by Mr. H. F. Johnson, was also shown.

Amongst the rock specimens displayed were examples of basalt, dolerite, varieties of lavas, volcanic ash, diorite, and other igneous and volcanic specimens; also good examples of granite, syenite, graphic granite, porphyritic granite, gneiss, &c., together with examples of chlorite-, mica-, and hornblende schists, quartzite and sedimentary rocks of the Palæozoic age; also sandstones, limestones, and grits. The Rev. C. G. Nicolay also sent fossils from the Geological Museum, Fremantle, including a cast of the spine of *Edestes Davisii* (*H. Woodward*) from the carboniferous of Gascoyne River, figured and described in Geological Magazine, 1886, p. 1; also some Tertiary fossils and specimens of a crustacean, the *Thelassina Emerii*, from Cambridge Gulf, Kimberley.

NEW ZEALAND.

New Zealand had a most interesting display of the mineral products of the Colony. The chief exhibitors were the able Director of the Geological Survey Department, Dr. James Hector, C.M.G.; the Public Works Department, Wellington, in charge of Mr. John Blackett, the chief engineer; the Bank of New Zealand, and the Minister for Mines, Wellington. Many others also contributed to render this one of the best displays in the Exhibition. The whole was excellently arranged under the direct superintendence of Sir Julius von Haast, K.C.M.G., one of the Commissioners.

At the present time gold is the most important and valuable of New Zealand's mineral products. Mr. F. Woollams exhibited some pretty specimens from different claims, some of which were polished; the gold in one specimen was in thin folia, very pale in colour; some of the plates were coated with drusy crystals of quartz, and the specimens showed great similarity to many Transylvanian (European) specimens. Lady Bowen showed several examples of auriferous quartz, one with leaf-like gold in beautifully white quartz from Reefton, another with calcite from the Thames District, and one from the Caledonia Mine. Some rich specimens were shown by Mr. H. Hayman. The Bank of New Zealand exhibited gold quartz of considerable richness in which the gold was in patches and veins. This specimen came from a rich corner in the "Keep it Dark" Gold Mining Company, Reefton. Mr. J. Liddell showed a specimen of quartz in which the gold was very finely divided, and which also contained silver: this specimen came from the Woodstock Mine, Karangahake. Specimens were shown by the Venus Gold Mining Company, Murray Creek, containing pyrites, galena and copper pyrites. Alluvial gold is found in Otago, Westland, and Nelson. The Department of Mines

exhibited many interesting examples of alluvial gold from various localities. The Bank of New Zealand also showed several fine nuggets.

Silver is largely obtained from the gold of the Thames district. A very characteristic variety of quartz, containing both gold and silver, and termed a chalcedonic quartz, was shown by Mr. J. McCombie from the Silverton Mine, Waihi Ohinemuri: this specimen is a mixture of chalcedony and quartz, sometimes having cavities lined with quartz crystals. Similar specimens were exhibited from the Rosemount Mine, Waihi, and from the Scotia Gold Mine, Karangahake, and others. Specimens of argentiferous galena were shown by Mr. T. Cornes, from the Champion lode No. 3, and by Mr. J. Coulter, from the Crown claim and Marlborough gold-field, Thames. Large examples of another New Zealand silver mineral, locally named Richmondite, from Richmond Hill, and Golden Bay, Nelson, were shown by Mr. D. Bayfield, of Nelson, and Dr. Hector. It is probably a variety of grey copper or tetrahedrite, and contains lead, antimony, copper, zinc, iron, and silver. It has a steel-grey colour, and but little lustre.

The copper minerals were represented by some large flat masses of native copper, sent by the Champion Copper Company, Nelson. Native copper was also shown disseminated through a serpentine from Aniseed Valley, Nelson. Specimens of copper pyrites, of good quality, were shown from Moke Creek, Wakitipu Lake, Otago. Copper glance and cuprite are found on D'Urville Island, Nelson, and specimens were shown by Dr. Hector.

Lead, in the form of galena, is found in a very pure condition at Perseverance Mine, Collingwood, and other specimens were exhibited from Wangapoka, Nelson, associated with antimonite and iron pyrites.

Many varieties of iron minerals were exhibited by New Zealand, notably the magnetic iron-sand from Taranaki, shown by Dr. Hector. The black sands are found abundantly on the sea-shore of the west coasts of both islands, most of which are titaniferous. Dr. Hector also exhibited specimens of brown hæmatite from Parapara, Collingwood; this seems to be of the bog-iron type, and is found on the surface in considerable quantities. From the same locality came a large block of ochry-red iron, and some specimens of bog-iron ore. Another similar ochry-red iron was shown by the Canterbury Museum, from Waikarake Creek, Thames; blackband ironstone, from the Coal Measures, is also found in New Zealand; a massive hæmatite was exhibited by Mr. W. Oliver, from the Marlborough gold-field, and spathic iron was shown by Dr. Hector from Collingwood.

Large blocks of antimonite, coated with cervantite, were exhibited by the Endeavour Inlet Antimony Company, Wellington. Some fine specimens of crystallized antimonite were shown by the Department of Mines, from the Prince Imperial Mine, and the Cambria Mine, Thames. There were some in acicular crystals from the latter, with barite in flat tabular crystals, similar to the Hungarian specimens.

Zinc-blende was shown from Tararu Creek, Thames, and also associated with galena from Collingwood.

Manganese was represented by some large specimens of psilomelane from the Bay of Islands, shown by Dr. Hector, together with specimens of pyrolusite; other examples of psilomelane were exhibited from Onehunga, by the New Zealand Iron and Steel Company.

Mercury, in the form of cinnabar of fine colour (native vermilion), with native mercury from Ohacawai, Bay of Islands, was exhibited by Mr. W. Earl. Specimens of cinnabar, in the form of rounded pebbles and grains, were shown from R. McKinlay's claim, Lower Nevis, Otago, and from Waipori, Otago, by the Department of Mines.

Chromic iron is found in abundance in Nelson, and large specimens were exhibited from Aniseed Valley; it is also found at Whangamoa, and at Dun Mountain, Nelson. Dr. Hector exhibited these specimens. Sometimes the chromite is disseminated through the rock in spots.

Native arsenic, in the usual mammillated form, was shown from Kapanga, Auckland.

Amongst the miscellaneous minerals exhibited were some interesting specimens of schorl, in groups of long diverging crystals, imbedded in massive chlorite. A compact specimen of scheelite, or tungstate of lime, from Buckleburn, Otago, was shown by the Department of Mines; a poor variety of graphite, from the Collingwood range, Nelson; a pretty specimen of fuchsite, from Dusky Sound, Otago. Specimens of sulphur of a fine pale colour came from White Island, Auckland; a very delicate specimen of selenite also from White Island. A fine large specimen of obsidian was exhibited from Mayors Island, Auckland; also some very interesting specimens of siliceous sinter or geyserite, from Lake Rotomahana hot springs, were exhibited by Dr. Hector. These had various fantastic forms.

Some large blocks, perfectly rounded and waterworn, of jade or nephrite may be considered as examples of New Zealand greenstone. The Maori name for this stone is ponamu. There was a good display of it, as well as of many objects into which it is fashioned. Some of the trinkets of various kinds manufactured from it are of the finest green colour. A fine collection of Maori clubs or meris, heitikis or native deities, and of other native ornaments made of this stone, was exhibited by Dr. W. L. Buller, C.M.G. The stone is exceeding tough, moderately hard, and not easily broken, though it is difficult to polish.

Dr. Hector exhibited, on behalf of the Geological Survey of New Zealand, an excellent series of well-classified rock specimens.

The Canterbury Museum exhibited three grand specimens of the extinct gigantic bird, the moa—*Dinornis didiformis*, *Dinornis elephantopus*, and *Dinornis maximus*, the latter specimen standing at least nine feet high. These magnificent specimens were excavated and articulated by Sir Julius von Haast, the director of the Canterbury Museum. A unique specimen also of the egg of *Dinornis* was exhibited by Mr. E. D. Rowley, and casts of the bird's footprints in sandstone from Poverty Bay.

There was also an excellent and extensive series of the fossils of New Zealand, exhibited by Dr. Hector, from the Tertiary, Secondary, as well as Palæozoic-Carboniferous and Silurian formations; also a quantity of fragments of bones of *Dinornis* and of dog from Shag-point, from the kitchen-middens of ancient moa hunters, with some stone implements.

Other objects of interest were some cases of feathers of the extinct moa, from Mount Nicholas Cave, exhibited by Mr. Taylor White; also similar specimens from the Queenstone Cave.

CAPE OF GOOD HOPE.

The Cape of Good Hope, in this Exhibition, will always be remembered by the great display of diamonds, and the diamond-producing rocks, minerals, and earths, &c., brought together by the united energies of the Cape Commissioners and the Kimberley Local Committee. Mr. E. J. Dunn, F.G.S., the Cape Copper Mining Company, and others also exhibited various minerals, rocks, &c.

The diamonds were first found in what are termed "river-diggings,"* a deposit of gravel more or less ferruginous, with sand, and a kind of tufaceous limestone and boulders, and pebbles of agate jasper, dolerite, quartz, and some zeolitic minerals, formerly an old river alluvium. When the dry diggings were discovered, alluvial diamond-mining was almost abandoned. The material, commonly termed "matrix," in which diamonds are found in the dry diggings, is a bluish or greenish-looking, unctuous, clay-like substance, appearing like an altered or decomposing conglomerate, soapy to the feel, more or less hard, or sometimes friable. Above this "blue stuff" is the so-called "yellow stuff," having much the aspect of mortar. Diamonds are also found in this deposit.

The following Companies contributed to this fine display of natural diamonds:—The Compagnie Française des Mines de Diamants du Cap, Kimberley; The Phœnix Diamond Mining Company, Dutoitspan; the De Beers Diamond Mining Company, De Beers; The French and D'Esterre Diamond Mining Company, and the Bultfontein Mining Company, Bultfontein. It is a remarkable fact, that in so comparatively small an area there is a great variety of distinctive characters among the diamonds found in these different companies' claims, so much so that experts can at once determine the mine in which certain diamonds were found. For instance, from the Kimberley Mine comparatively few of the finest white stones are produced, but many of what are known as "Cape white," which are very slightly tinted, in addition to what are termed "bye-water," still less white, and yellow. Very good forms of the octahedron were shown, which is typical of this mine, as well as some fine yellow-coloured specimens, many of which were exhibited in the matrix.

The De Beers Mining Company showed some fine dodecahedrons slightly yellow; this form of crystal seems characteristic of this mine; also some white "flats," which are either flattened octahedrons or twin octahedrons, are found—these forms are typical of all the Cape localities, and especially of De Beers. Some very fine yellow crystals were also exhibited, one especially large and fine octahedron in the blue matrix. One very magnificent and perfect octahedron, of a delicate straw colour, weighing 155½ carats, and a similar one of 92½ carats, was shown by this company. Some stones of a brown, bright yellow, and other colours, called "fancies," were also exhibited, as well as some very elongated crystals. Some of the triangular flats are so singularly clear and limpid that they appeared as if polished, so fine is the surface. Many of the octahedra also appeared to be polished.

* The description of the methods of obtaining the diamonds will be found in Dr. Le Neve Foster's Report, p. 39.

From the Dutoitspan a large variety of yellowish stones were displayed. The diamonds from this mine are very similar to those from De Beers and Kimberley; but the white stones are better in quality, and more in proportion. The Dutoitspan Mine is the largest in area of all the four mines exhibiting, and most of the largest specimens have been discovered at this mine. The largest stone shown in the Exhibition was a flattened octahedron, of a yellowish colour, weighing 199 carats, and found at Dutoitspan by a Mr. Mylchreest.

The Bultfontein Mining Company, and the French and D'Esterre Diamond Mining Company exhibited some very fine white stones from Bultfontein Mine, mostly having an octahedral form; these appear to be the whitest of any exhibited. Some, though white, do not seem clear; this is due to numberless striæ on the surface only, so that after polishing they develop into remarkably clear stones. Some crystals have black specks in the interior. A very fine octahedral stone, with the planes of a rhombic dodecahedron, of 29 carats, considerably striated, was shown by this Company. Fine white crystals in the matrix were exhibited by Mr. S. Ochs. The Bultfontein Mining Company has now the largest area of any of the South African Mining Companies, having quite recently purchased additional claims, making up their total to 160 claims. It is well known that this mine produces diamonds of the finest quality, mostly exceedingly white and clear, but a portion of them with small specks, when the principle of cleaving is resorted to, in order to remove these imperfections, leaving the stone perfectly clear and but little reduced in weight. The stones are not usually of large size; the yellow and brown stones found are the exception at this mine, instead of the rule, as at the other mines. Messrs. Ochs Bros. of London have the management of this Mining Company; their Manager at the diamond fields is Mr. A. W. Davis.

With regard to the crystallographic form, the octahedron seems the most abundant in the South African mines. Next in frequency are the twinned or macled crystals or "flats," the least common being the rhombic dodecahedron. The form of the cube does not appear to be found in South Africa. Many of the crystals are flattened, elongated, or otherwise distorted; many are split or cleaved when found, owing to the natural easy cleavage of the mineral; and the term "cleavage" as used by the dealers is often applied to the so-called "flats," as well as to the cleavage artificially produced when removing faulty portions from imperfect stones, a device practised by experienced persons with singular adroitness. These flat pieces are used in the making of rose diamonds, in which thickness of material is not necessary.

It is stated on the authority of Mr. Theodore Reunert that the largest diamond hitherto found at the Cape, and the most perfect for size, was discovered at Dutoitspan, in September, 1885. It has the form of a large irregular octahedron, is pale yellow in colour, and slightly spotted. It weighed 404 carats, or nearly 3 ozs. The "Porter Rhodes" diamond, discovered in the Kimberley Mine in 1880, was previously considered to have been the finest stone ever found in South Africa. It was a pure white stone of 150 carats, and has been valued at £60,000. Both of these, however, have been far eclipsed by the magnificent stone now called the "Imperial" diamond. This specimen was found in the Orange Free State. It is of the finest bluish-white colour, and weighed in the rough

state 457 carats. It had a somewhat irregular oblong form, and in order to improve the shape, the "Imperial" had a piece slit off from one end. As an indication of the fine quality of the stone, it may be mentioned that this piece was cut into a brilliant of 19 carats, which was disposed of to a merchant for £4000. The chief portion of the stone was afterwards cut and formed into the finest brilliant in the world. It now weighs 180 carats.

Considerable prejudice has existed against the Cape diamonds, from the fact that they were stated to be all discoloured stones; but the recent splendid exhibition should be quite sufficient to dispel this idea, and to prove that there is a profusion of white stones as well as of coloured. Most of these off-coloured stones are exceptionally brilliant at night, even rivalling the finest white diamonds.

The variety of diamond termed "Boart," plentifully found in South Africa, is frequently opaque. The crystals when translucent are of very imperfect material or quality, and quite valueless for cutting; this is the kind largely employed in the polishing of other diamonds, also for slitting stones, drilling stones, seal engraving on stone, cameo cutting, &c. The boart is crushed, and used in the form of a rather fine powder, mixed in oil of some kind, depending on the work to which it is to be put.

Messrs. Ford and Wright exhibited the whole process of cutting and polishing the diamond at their stand in the Court.

A singular exhibit by the detective department at Kimberley was a collection of imitation natural diamond crystals, which are employed as a means of detecting the illicit buyers of stolen diamonds. One shown was an octahedron of considerable size, which was sold for £500, and was the means of causing the arrest of the purchaser.

A recently introduced ornamental stone, known under the name of Crocidolite, was displayed in the Cape of Good Hope Court in considerable quantity. This stone was first brought to Europe about 1777, by Le Vaillant, a French traveller in South Africa; later (about 1822) by the Rev. John Campbell, a South African missionary, and by others, and was introduced as an ornamental stone in England about 1870. The name Crocidolite was first given to a blue fibrous mineral by Hausmann in 1831, but it was called *Blaueisenstein*, in 1811, by Klaproth, who at that time announced it as a new species, the name being derived from κροκὶς or κροκύς, signifying *woof* or felt (from its fibrous or matted structure). Another suggested derivation is κροκο-ειδής, saffron-coloured, which is at least appropriate to the yellow variety. In either event the name should be pronounced Krokidolite, as spelt by the Germans, and not Crocidolite, as is usual here.

The mineral is found in the northern part of a range of hills called the Asbestos Mountains, some forty miles north of the Vaal River, in veins from half an inch to 3 inches in thickness, in a porcellanite or highly ferruginous porcelain jasper as its matrix. The matrix contains also thin veins of strongly magnetic iron. The colour of this beautiful stone is generally of a fine rich dark golden yellow. When polished or fresh broken it has a fine satin gold-like lustre. Sometimes it is more or less striped with blue or green, forming a fine contrast; rarely it is of a dull red, often of a bronze yellow, but always with the same satin-like lustre when polished. In Germany the name "Tiger-eye" is given to the yellow-coloured stone.

The yellow variety is probably an alteration or pseudomorph of the blue fibrous mineral by infiltration of silica. It contains a large amount of sesquioxide of iron, to which it owes its yellow colour. This is altered to red by the action of heat, an effect which can easily be produced by artificial means. Occasionally an almost pure white fibrous quartz is found containing little or no iron in some veins.

It is now largely employed for ornamental purposes, as well as for trinkets and jewellery, and may be classed as a semi-precious stone. When cut *en cabochon* it exhibits a ray across the fibre, as a cat's-eye, and in reality it is a quartz cat's-eye, a variety of quartz having minute fibres of asbestos running through it, and often ferruginous to a small extent. A beautiful circular table of inlaid crocidolite of exquisite workmanship was exhibited by Mr. T. Paton of Dalry, Ayrshire, which is really quite a work of art. Other exhibitors were Messrs. Harris and Lehmann of Kimberley, Joseph and Gluckstein of Victoria West, Lilienfeld Bros. of Hopetown, and Elias Harris of Dutoitspan, who exhibited an endless variety of ornaments and trinkets, such as table tops, inkstands, paper knives, stick handles, buttons, &c., also some exceedingly well-cut cameos. Messrs. Harris and Lehmann also exhibited specimens of the blue fibrous variety.

The matrix of crocidolite, the banded jasper, would also form an exceedingly pretty ornamental stone. It occurs often of a red colour, with stripes of yellow and brown alternating with red and black, and as it is capable of taking a brilliant polish and not easily scratched, it might be adapted with advantage for ornamental purposes.

Amongst other minerals from Cape Colony were salt entirely derived from the natural salt pans, apophyllite in beautiful brilliant crystals from Kimberley, natrolite, heulandite, calcite and iron pyrites from Dutoitspan, iron glance, jasper pebbles, allanite, garnets (called Cape rubies), a finely crystallized apophyllite from De Beers, and a very fine large stalactite 8 feet long from a cave near Danger Point, in the Caledon District, shown by Mr. W. G. Anderson, Junior.

A very excellent series of rock specimens, collected by Mr. E. J. Dunn, was exhibited by the Commissioners. It consisted of about 750 interesting examples of jaspery ironstones and porcellanites and other Griqualand specimens. Messrs. Hill and Paddon showed some blocks of a bone breccia, and a good illustration of the detritus from the diamond river diggings from the Vaal River. Some of these pebbles, &c., were displayed in bottles of water, which better exhibited the colour and character of the stones, probably mostly derived from disintegrated amygdaloidal rocks. Other rocks from the diamond regions exhibited were examples of granite, mica-schist, gneiss, chlorite-schist, dolerite, hornblende rock, gabbro, omphacite, olivine and quartzite, ilmenite, garnet, magnetite, zircon and vaalite.

A large and instructive collection of native stone implements was exhibited by Messrs. T. Bain and E. J. Dunn.

NATAL.

The mineral display in the Natal Court was not of the most extensive character, and owing to the limited space it was not exhibited to the best advantage. Some specimens might even have been overlooked, from being separated from the bulk of the collection. The gold specimens, though not strictly from Natal proper, are the chief minerals to be noticed, and though coming from the Transvaal Territory, Natal is chiefly interested in developing these gold-fields. The chief exhibitors were Barrett's Berlin Gold Mining Company, Moodie's Gold Mining and Exploration Company, The Victoria Reef Gold Mining Company, and the Caledonia Gold Mining Company.

Specimens of gold quartz and alluvial gold were shown by Mr. A. L. Lawley from the Kaap Gold Field, Transvaal; and among other specimens a rather large nugget and some coarse grains of gold. Some of the above claims show specimens having indications of copper. The Spitzkop (Lydenburg) Gold Mining Company had their case of specimens in the Cape of Good Hope Court, near the entrance of the Natal Section, and exhibited gold dust in a finely divided state; also a somewhat scaly example, as well as coarse gold and small nuggets; also specimens in ironstone and quartz, in addition to a small bar of smelted gold of 100 ozs.

Iron ores appear to be more abundant; good specimens of magnetite were shown by Mr. P. Norton, specimens of red ochre from the Newcastle coal-field, and yellow ochre of various shades. Umbers, &c., were exhibited by Mr. D. C. Wakerlin of Durban. These were shown under the name of earth paints, and were all varieties of iron oxides. Mr. P. Norton also showed a series of these earths. Some important ores of iron are found at Prestwick, near Dundee.

Specimens of plumbago or graphite were exhibited by Mr. W. Kenrick, but of poor quality. Specimens of chrysotile, or fibrous serpentine, from Durban, were shown under the name of tremolite by the Natal Commission. Mr. H. Shuttleworth exhibited mica, but of too small dimensions to be of any value. Mr. P. Norton showed a kind of nodular limestone, probably a calcareous tuff, similar in appearance to the Indian "Kunkur." Similar kinds of tufaceous limestone are found in many parts of South Africa.

A series of fossils was exhibited by Mr. W. Bazley, including some ammonites, inocerami and other cretaceous fossils from the Umtamvuma River. A slab, probably cretaceous, having the impressions of two specimens of fossil fishes in a good state of preservation, was exhibited by the Rev. J. Scott of Pietermaritzburg, and the Natal Society showed some specimens of stone implements.

ST. HELENA.

St. Helena contributed a small collection of lavas and other volcanic products, forwarded by Mr. J. C. Melliss.

ASCENSION.

From the Island of Ascension a few volcanic specimens were exhibited, including pumice, obsidian, lava, and the calcareous coarse sand formed of fragments of shells, &c.; also some specimens of iron glance of brilliant steel-grey colour on lava, shown by Admiral Sullivan.

CEYLON.

The display of the mineral resources of Ceylon, though occupying little space in contrast to some of the Courts, included a show of precious stones which was the best in the Exhibition. The gem collection was in charge of Mr. James Hayward, who has had many years' experience in the gem districts in Ceylon, and to whom I am indebted for much valuable information as to the localities and nature of the Ceylon gem exhibits. The principal exhibitors of minerals were the Government of Ceylon, who showed precious stones, graphite, iron ore, &c.; Messrs. Morgan and Co., of the Battersea Crucible Works, Messrs. Fernando, I. de Mel and W. Gunasekara, who showed graphite; Mr. C. H. de Soysa, J. P., one of the executive committee, and Messrs. R. C. Nockold and E. W. Streeter, who exhibited some choice specimens of Ceylon gems in the polished as well as in the natural state.

The precious stones are mostly obtained from the district of Suffragam, within a radius of 30 or 40 miles from Ratuapura ("the city of gems"), the capital town of the district. The most important Ceylon stones are sapphires, and of these the most highly prized are from the Rakwana district. The stones from this district, too, are of the richest colour. Rubies, cat's-eyes, chrysoberyls, alexandrites, spinels and many others are found in the same locality.

Sapphires were displayed in a profusion of colours, including many choice velvet blue-stones, the "Bleu de Roi" of the rarest colour. There were also stones showing numerous shades of blue, from the palest to almost inky black; lavender tints, blue tints with just a sufficient red tone to render the stone of a rich blue by artificial light—a by no means common effect, most sapphires having a somewhat inky or blackish colour by night; some again with more red, rendering the stone a brilliant amethyst colour at night, though a fine blue by daylight; others of a peculiar cold-looking green colour—a rare stone in Ceylon; others of a pale violet and pinkish in tint, with a faint opalescence or murky appearance, very singular specimens. There were also specimens of the variety called ruby reached through many shades, from pale pink to crimson; garnet-coloured stones; and stones of the brilliant so-called "pigeon's-blood" colour, many of the highest value as gems. This colour is usually seen in specimens from Burmah and Siam, rarely in those from Ceylon, the ruby of jewellers being in reality a red sapphire. The Ceylon rubies for the most part are of a deep rose-red colour, sometimes pale, often

approaching fine crimson. Many shades of red are found, often with a silky-like chatoyant flash. In Ceylon rubies this is technically termed "silk." A grand specimen of a Ceylon ruby, of a remarkably fine crimson colour, 20 carats in weight, and valued at £2000, was lent by Mr. R. C. Nockold, and was one of the finest specimens from the island. Another fine Ceylon ruby, mounted as a ring, was exhibited by Mr. de Soysa. Yellow sapphires of extreme beauty, and of a variety of shades, were exhibited. The tints included yellow with a brownish tint, straw colour (the usual colour), deep sherry colour, and almost a salmon tint. These last are sometimes called Oriental topazes. Some perfectly white sapphires were also exhibited, others with the slightest shade of blue or yellow, almost imperceptible, except by the side of colourless ones; others again of a violet hue, and others of the very fine colour sometimes called Oriental amethyst. There were star sapphires of remarkable size and colour, bright blue, grey, violet, lilac and ruby, showing in bright sunlight six-rayed stars of singular beauty. These curious stones are cut from somewhat opaque material at right angles to the natural prism, the apex of each ray terminating in the centre of each plane of the prism, and meeting in the centre of the stone. They are cut *en cabochon* with more or less convexity. A fine specimen of a brown crystalline corundum, polished in the same manner, showed a somewhat imperfect star, and could hardly be called a star-stone, though it is sometimes so described. One enormous star-stone, of a greyish colour, weighed 723 carats; and another, of a darker bluish colour, 264 carats. These stones are almost peculiar to Ceylon. A tray of fine star-stones was exhibited by Mr. Nockold. It contained specimens of various colours, and a large cross 6 inches long, formed of eleven large star-stones; rubies and other stones were set in the same ornament. Some beautiful natural crystals of sapphire of many colours were also exhibited, many of large dimensions, but not sufficiently perfect to be cut into large stones; still they were of considerable interest, as displaying the many forms of this mineral. The crystals are often distorted and considerably rounded by attrition in the old beds of rivers with other detritus. Two very fine blue crystals of large size were shown, as well as yellow, violet, white, and variously tinted specimens. There were some examples of corundum, or an impure coarse variety largely employed in many of the arts, for grinding purposes.

Ceylon is the country *par excellence* for spinels of fine quality, valuable as gems; and some were shown of unusual excellence, and of many tints. No precious stone includes so wide a range of colours as the spinel, but they are mostly of quiet unobtrusive shades, few having the brilliant colours of some other species. The red spinel, or "spinel ruby," is perhaps the brightest, but it does not approach the true ruby for magnificence of tint. It shows many shades of red passing into violet, and so on through puce to purple and indigo, or to a fine greenish blue. Brownish orange and pink shades are known under the names of Rubicelle and Balas ruby. The stones exhibited by Mr. Nockold illustrated a fine variety of colours of this species; small crystals also of the spinel ruby were shown, having the usual octahedral form. The fancy coloured ones and those of larger size are generally found as rounded pebbles, rarely in the crystallized condition.

Chrysoberyl is another important precious stone found in Ceylon. It is

known to jewellers as chrysolite. There are three varieties of this gem, under the names of chrysoberyl, cymophane, sometimes termed chrysoberyl cat's-eye, and alexandrite. The variety called chrysoberyl includes the transparent specimens usually of a pale greenish yellow, running into a rather dark brownish yellow. The cymophane or true cat's-eye is translucent to almost opaque, and which when cut *en cabochon* exhibits that peculiar movable ray like the eye of the cat, sometimes as a broad flash, sometimes as a sharp line. This effect to some extent depends on the cutting, and whether the apex is acute or obtuse. This singular character is owing to the minute internal striations in the constitution of the stone. All fibrous minerals will exhibit this cat's-eye-like ray if cut in the same manner. The finest cat's-eyes are found in the gem-pits of Moruwa Korle, but some are found in the other districts. The alexandrite is a variety of a deep, somewhat bluish green colour by daylight, and has the singular property of appearing of a garnet red or brownish red by gas or candle light. The largest stones as gems are found in Ceylon, in the gem-pits of Moruwa Korle, associated with the cymophane. This seems to be the only locality in Ceylon, but the finest shades of green, and consequently the brightest red at night, are from Siberia. The name is given in honour of the Emperor Alexander. The chrysoberyl occurs also as a gem in Brazil. In the collection exhibited were some remarkably fine specimens of the cymophane, or cat's-eye; the finest shown is the property of a native moorman, by whom it is valued at £3000; it measures 27 mm. by 24 mm. Some fine specimens were also shown by Mr. Nockold, Mr. C. H. de Soysa, and the Ceylon Government. The latter also exhibited some fine cut alexandrites, of which a splendid cut specimen is shown by Mr. Nockold. There was also a probably unique alexandrite cat's-eye, which seems to have been unknown previously. It is of a dark bottle-green colour, but by artificial light it has the peculiar red tint. In Mr. Nockold's cases were several cut specimens of the pale yellow chrysoberyls, as well as some of the brownish tint; also a very fine natural twinned crystal, having the usual form of the alexandrite crystals from Siberia, that is, hexagonal, with the edges bevelled. These compound crystals of transparent chrysoberyl appear to be very rare. A large rough specimen of cymophane was also shown.

Zircon, under the name of jargoon, was found until recently as a gem exclusively in Ceylon; latterly, however, it has been discovered in New South Wales. The mineral itself, but unfit for cutting purposes, has been found in many other countries. It occurs in Ceylon of many shades of colour, from white to yellow, and through various shades to brown and green. These are generally termed jargoons. A deep rich brownish-red variety, similar in colour to the Cape garnet, is sometimes found, but not in such plenty as in New South Wales; this is the true hyacinth or jacinth, but must not be confounded with the essonite or cinnamon stone, which is only a variety of garnet, though called by jewellers jacinth. This is very abundant in Ceylon. Some of the jargoons when heated lose much of their original colour, and frequently become almost white, in which state they have been disposed of for inferior diamonds; indeed they are sometimes called Ceylon or Matura diamonds. This stone is remarkable for its almost adamantine lustre and great density, being the heaviest of all the precious stones. It owes to its high refractive power its great lustre or "fire," which approaches that of the diamond more nearly than any other stone.

In composition it contains essentially 67 per cent. of zircon and 33 of silica. In the two cases exhibited by Mr. Nockold a variety of colours of this interesting stone are shown, along with gems of several other species. A small parcel of rough crystals of zircon were also shown by the Ceylon Government, together with some rough water-worn pebbles of the green and yellow varieties.

The tourmalines found in Ceylon are mostly of a brown colour, but when cut in the brilliant form have considerable lustre and beauty. Mr. Nockold exhibited a few very fine specimens of this variety exquisitely cut; it occurs of many colours, but the fine olive green, blue, and red are best known. These three only appear to be found but sparingly in Ceylon; the former two are almost exclusively Brazilian, while the finest red stones or Rubellite occur in Siberia and in the United States. Some of these latter when carefully cut are of a very fine colour, varying from rose to deep red, sometimes approaching the ruby in tint, and often of considerable size. The green and blue varieties often occur of large size, and all when fine realize high prices. The distinct dichroism of this stone is one of its remarkable characters, and renders it of value in the manufacture of certain optical instruments. Some black crystals when prepared in thin slices appear as transparent plates, and if clear are valuable for polarizing apparatus.

Garnets are not found in Ceylon of such size and quality as in India, the cinnamon-stone or essonite, which is a lime garnet, being the most typical of the Ceylon varieties of garnet. It is found in some plenty. This is generally but erroneously known as jacinth; it is of a rich dark yellowish-brown colour, and was much in use by the ancients for cameos and intaglios. It is not so hard as the almandine or violet garnet, or the brownish-red kinds, which when cut *en cabochon* are known as carbuncles. There were some well-cut specimens of cinnamon-stone in Mr. Nockold's cases.

The topazes in Ceylon are chiefly white, and are found as rolled pebbles from quite small dimensions to several pounds in weight. Some of these pebbles were exhibited, but the topaz is a stone of little value as a gem. Its greater density is sufficient to distinguish it from rock crystal, which it much resembles.

Beryl is found but rarely in Ceylon. A few rough specimens were shown, but they are of little value for cutting purposes.

The quartz group appeared to be only illustrated by a very fine-coloured cut and polished amethyst, and a large and fine specimen of false topaz or cairngorm, sometimes called citrine. This specimen was an exquisite example of the lapidary's art. Amongst the rough specimens was a large crystal of quartz, with several water cavities in which are air bubbles, which are movable as the position of the crystal is altered; and another large quartz crystal, somewhat smoky, which is termed by the exhibitor a "water sapphire," and has some tolerably clear parts in its centre. There were also some rough specimens of pale amethyst crystals, and some specimens of the quartz containing long needle-like crystals of the mineral rutile, and sometimes called sagenite.

Of the moonstone a large number of polished specimens were shown, which were very pretty. Jewellers have always appeared to have had a prejudice against the introduction of the moonstone into articles of jewellery

and ornament; latterly, however, there seems to be a movement in favour of it in the cheaper forms of personal ornaments, and a number of specimens mounted as bracelets, necklets, hair-pins, &c., were exhibited and priced at a very reasonable rate. This stone has a peculiar silvery opalescence when cut *en cabochon*—the usual mode of cutting—and would have good effect if employed with such stones as amethyst, cairngorm, and other inexpensive stones. It is a variety of adularia, a form of orthoclase, and although found in other localities is essentially a Ceylon stone. It is found in a pegmatite rock, of which examples were shown by the Ceylon Government.

Iolite or dichroite, called also "water sapphire," is found in Ceylon, but was not represented.

MAURITIUS AND SEYCHELLES.

The only minerals shown by these islands were three rounded specimens of pumice washed ashore from the volcanic eruption in the Straits of Sunda, samples of coloured clay, a fine crystal of smoky quartz, a pale specimen of amethyst quartz, a scaly variety of mica, much altered, and a specimen of hornblende, exhibited by Mr. H. Whatley Estridge.

STRAITS SETTLEMENTS.

The Hon. D. F. A. Hervey, Malacca, exhibited specimens of stream tin and tin sands, and specimens of ironstone, &c., from Johol and Geminchi gold-pit. The Government of Perak showed wash and tin sand from various regions, gold-bearing tin sand from Batang, Padang, and specimens of gold dust washed from tin sand from the same locality.

BRITISH GUIANA.

British Guiana exhibited a specimen of pipeclay and a variety of sand, both from the River Corentyn; a series of very small rock-specimens, with a few minerals, shown by Mr. C. Barrington Browne; and a specimen of gold.

WEST AFRICAN SETTLEMENTS.

SIERRA LEONE.—Mr. E. Vohsen exhibited a fine specimen of magnetic iron ore of very rich quality; this if found in sufficient quantity ought to be a valuable ore. Mr. A. B. C. Sibthorpe showed a good limonite, or

brown iron ore, from the Scarcies. Dr. W. B. Davies showed a bog-iron ore from the Timmanee country, which is said to contain 68 per cent. of iron, also a much decomposed magnetic iron ore. Mr. W. H. Davison exhibited a specimen of plumbago or graphite, under the name of antimony ore. This mineral is from Sherbro.

GOLD COAST.—One of the most prominent displays in this Court was the fine case of gold quartz specimens exhibited by Messrs. F. and A. Swanzy. Many of these were of extreme richness, and were derived from a mine originally the private property of the exhibitors, and known as Crocker's Reef. Messrs. F. Swanzy and F. J. Crocker also showed various nuggets of a fine rich colour. Natural nuggets, drilled and strung as necklaces and ornaments, were exhibited by Mr. G. P. Cleveland, J.P., and by Mrs. Addo. There was an extensive and splendid display of pure gold personal ornaments, of native workmanship, many of which were paid by the King of Ashanti as a portion of the indemnity claimed at the end of the war in 1874. These were lent by Sir A. J. Adderley, K.C.M.G., the Commissioner for the West Indies, the Gold Coast Commission, the Gold Coast Government, and other exhibitors.

In conclusion I have here to tender my best thanks for much assistance rendered by the various officials representing the different Colonies in the preparation of notes for my Report, and also to express my appreciation of the valuable and useful Catalogues, Reports and Handbooks prepared for this Exhibition by the different Colonial Authorities.

MEAT AND DAIRY PRODUCTS.

By CLARE SEWELL READ.

UNDER no circumstances would it be an easy task to give in a few pages a general and comprehensive report of the meat and dairy products of our Colonial Empire. The materials for such a report are extremely voluminous, and some of them difficult to classify, but a skilful writer has already brought before the public a tabulated statement of the resources of the different Colonies for producing meat, butter and cheese.* My task is limited to the products exhibited in the Exhibition and Colonial Market, and I am officially directed that anything outside that radius must not come under my notice. As some of the Colonies which supply this country with large quantities of meat have no specimens in the Exhibition, it follows that my report may appear one-sided, and must necessarily be incomplete. Again, many of the articles exhibited were more or less spoiled by the voyage, the exposure, and the changes of temperature to which they were so long exposed. To harshly criticise these goods, many of which were evidently intended for early consumption, and could have stood a short journey without damage, would be unfair; and yet their condition is such that I am precluded from awarding them that measure of praise which they possibly deserved in their own country, while many of them were sold in the Colonial Market before I had an opportunity to inspect them. The Dominion of Canada, for instance, imports to the mother-country an immense quantity of live meat. As the journey is short, and her cattle and sheep have access to every market in the United Kingdom, she has not the same necessity for shipping dead meat as the more distant Colonies. Her exhibition of meat was therefore somewhat limited. A few sides of well-cured bacon and excellent hams were shown, and a great variety of tinned meats. These and the soups appear very good; but the most likely novelty to please the British taste is the boneless turkey and chicken, and the essence of beef. The different samples of Canadian butter which came under my notice did not impress me so favourably as the cheese. Some butter was a trifle rancid, but apart from this there did not seem the same uniformity of quality, or the same evidence of careful manufacture which was generally exhibited in the cheese. In this opinion I am supported by Professor Fream, who, in his British Association paper on "Colonial Agriculture," says: "Were the Canadian butter as well manufactured and as reliable a product as the Canadian cheese, our imports of butter from Canada would probably be far larger than they are." This remark, however, does not apply to the more recent importations of butter from Ontario. These

* Professor Fream's paper on "Colonial Agriculture," read before the British Association this year at Birmingham.

come from different creameries lately established in that Province, and are a great improvement upon the generality of the butter which I have seen imported from the Dominion. These creameries are of two kinds, those that take the milk direct from the farmers, and those which only receive the cream. The latter leave the skim-milk to be disposed of on the farm, where it is principally used for rearing calves. This system saves the carriage of the more bulky new milk, and would appear to be more likely to promote good husbandry. But the products of these different creameries are excellent and uniformly good. The butter was quite sweet and only slightly salted, and would no doubt be sold as fresh butter in the English market.

To say that the cheese was universally good, would be an exaggeration, but the great majority was well made, and of superior quality; none perhaps quite first class, yet much of it nearly approaching a truly high standard. Another good feature of the Canadian cheese was the absence of a really inferior article; the most ordinary having nothing calling for criticism beyond a deficiency in richness and flavour. Ontario appears to have gone ahead of the more Eastern Provinces of the Dominion, and the cheeses from the Ontario Farmers' Association were most creditable productions. Cheese factories are extending rapidly, and besides enabling the farmers to make the most of their milk, the Dairymen's Associations connected with them are the means of extending a scientific and practical knowledge of dairy management, which cannot fail to be productive of much good. Quebec furnished a large contingent of cheese, but it was not equal in quality, and was more variable in make than that shown from Ontario.

It is well known that Canadian cheese is mostly made upon the Cheddar principle, and that the shape of the cheese follows the form of our large cheddars, weighing from sixty to seventy pounds. There are, however, some of the Wiltshire make, more of the shape of our Stilton cheese, weighing about twelve pounds, but the manufacture of this more handy size entails an increased cost of 6 per cent. If Canadian cheese is sold at 6*d.* per pound wholesale in England, the Ontario farmers can make a good profit; at 5*d.* they can barely make two ends meet. Butter pays if it can be sold at 1*s.* per pound in England, and in the winter it will probably command a higher price. The carriage from Canada is really very small, not more than our Cheshire dairyman pays for sending his cheese to London. Now that the Canadian farmers are so rapidly developing their cheese factories and creameries, and thus improving the make of both butter and cheese, the English farmers will feel this competition more keenly than ever. One peculiar feature of the Canadian cheese is its early maturity. In two or three months it is ready for consumption, so that, as soon as it is imported, it can be retailed by the grocer. The taste for new cheese seems growing in England, and that for old and strong, and well-ripened cheese dying out, all of which must tell in favour of an extended demand for Canadian cheese, which is certainly mild and soft compared with some of our well-matured old-fashioned English cheeses. When the factory system is extended to the Eastern Provinces of the Dominion, there is no reason why the cheeses of Quebec should not equal those of Ontario and the Great North-West.

The Colonial exhibits of tinned meats were extensive and excellent. The most common class of these preserved meats appeared to be the corned beef. A little of it was over-cooked, coarse, and stringy, and not selected with that care which alone can secure for this class of food a good demand in this country. The present low price of English meat, and the still lower value of imported fresh meat, must tell against the enlarged consumption of these tinned goods; and it is only by selecting the best portion of the animal, and giving it the most careful preparation, that they can hope to compete with other meats. It seems also suicidal for the manufacturer to go to the expense of tinning anything save the primest meat, and incurring the same expense in the preparation and transit of an inferior article, as that expended upon a really valuable commodity. There can be no doubt that the consumption of tinned or canned meats has fallen off in this country considerably in the last few years. Compared with the quantity sold seven or eight years since, the American importation is now trifling; possibly not a fourth of what it once was. The reduction of the tinned meats from the United States need be no discouragement to similar Colonial products, as they are mostly superior in quality in every way. Much of the meat so prepared in the States is the product of lean Texan cattle, from which the prime joints have been removed to supply the hotels and markets of the Eastern cities, and so only the inferior portions of an inferior animal are used. This is not the case with the prepared meats of the Colonies. There is no population sufficient to consume all the best portions of the bullock or sheep, and therefore a much better class of meat is tinned in New Zealand and Australia. It is only in seasons of great drought, when some of the stock may be too lean, that any falling off in quality is observed.

It seems likely that such concentrated essences as "Extractum Carnis" and "Liebig's Extract of Meat" may prove the most profitable way of sending over preserved meat from the antipodes, and if a preparation similar to our "potted meats" could be sold here at a reasonable price, there is no doubt that a considerable demand would speedily spring up. A large consumption of common tinned meats, in the face of falling prices of beef and mutton, can hardly be expected; but there are many households in which they are the greatest convenience, whilst for ships, camping out, and where fresh meat is not easy of access, or cooking is a difficulty, there these tinned meats and soups are a real blessing.

The largely-increasing importation of fresh meat would show that this class of animal-food finds favour with the British public. There is no doubt that the frozen beef and mutton sent from Australia and New Zealand are excellent, and that the quality of the meat is all that can be desired. Indeed, the carcases of all the New Zealand sheep and a few from Australia which I saw at the Colonial Market prove that they are as well fed and as well bred as very many of the sheep of this country. They were almost all two-year-old wether sheep, and when slaughtered, no doubt, were mutton of the finest quality. But the fact of any meat being thoroughly frozen must detract from its flavour, and the appearance after it has thawed, especially in beef, is not in its favour. Even under the most favourable conditions the juices of the meat penetrate through the outside film of fat, and gives the joint a reddish tinge resembling extra-

vasated blood, and the meat speedily becomes damp and flabby. The thawing should be very gradual: it generally requires two days to expel the frost, and as soon as this has taken place, the meat should be at once cooked. If kept too long after thawing, no cooking will prevent it having an unpleasant odour, or restore its lost flavour. It has been said that there is an unreasonable prejudice against the frozen mutton and beef; but it cannot compete with fresh-slain meat at the same price, though it may be easily saleable at less money. The difference in the price of fresh killed prime meat and these frozen carcases of similar quality may be as much as *2d.* per pound; but the margin is greater when meat is very cheap, and smaller when the markets are exceptionally dear. This frozen meat has also to compete with the chilled beef sent from the United States. A great portion of this meat is never frozen, simply kept in cool chambers at a temperature of about 36°, which will preserve it quite long enough for sale in any part of this kingdom. On the other hand, the fresh meat from our Australian Dominions must be thoroughly frozen to preserve it through its long hot voyage, and when it comes out of the refrigerator it is almost as hard as stone. A preference, therefore, is not unreasonably given to the chilled meat of America, especially to the beef, over the carcases which have been subjected to such intense cold. It would altogether fail to convey a fair idea of the magnitude of the production of our Colonial Empire by simply noticing the chief samples shown at Kensington. Although it would be most unreasonable to fill a report of this nature with a mass of statistics, there is no other means of clearly placing before the British public the vast resources of our Colonial possessions, and the amount of meat and dairy products they are capable of furnishing, than by giving a few agricultural statistics.

Here then can be seen at a glance the number of cattle, sheep, and pigs which Australasia possessed in 1884:—

	Cattle.	Sheep.	Pigs.
New South Wales . .	1,336,329	30,379,871	211,656
Victoria	1,287,945	10,637,412	234,347
South Australia . . .	389,726	6,696,406	163,807
Queensland	4,266,172	9,308,911	51,796
Western Australia . .	71,102	1,547,061	20,039
Tasmania	128,834	1,720,027	57,303
New Zealand (1880) .	698,637	14,056,266	200,083
AUSTRALASIA . . .	8,178,745	74,345,954	939,931
In 1873	5,760,476	58,082,170	733,395

The census of stock in the United Kingdom for 1884 gave—

Cattle . 10,422,762 Sheep . 29,376,787 Pigs . 3,906,205.

These figures show the rapid increase of stock in Australasia, and the facts that New South Wales alone has more sheep than the United Kingdom, and Queensland has nearly half as many cattle. In the past ten

years the cattle of Queensland have increased threefold, those of South Australia have doubled, there are two-thirds more in West Australia, and one-half more in Victoria. The sheep have doubled in West Australia, in New South Wales they have increased two-thirds, in New Zealand one-third, and in Queensland one-fourth; but Victoria has a slight decline. The whole of the Australasian Colonies show in ten years an increase of cattle of over 40 per cent., and sheep and pigs of nearly 30 per cent.; and they have now two and a half times as many sheep, and four-fifths as many cattle as the United Kingdom.

These are the most recent statistics for Canada and the Cape Colony:—

	Cattle.	Sheep.	Pigs.
CANADA—Ontario (1884) .	1,925,670	1,890,733	916,158
Manitoba (1884) . . .	64,011	6,431	44,901
Quebec (1881)	1,030,333	889,833	329,199
New Brunswick (1881) .	212,560	221,163	53,087
Nova Scotia (1881). . .	325,603	337,801	47,256
CAPE COLONY (1875) . .	1,330,644	10,976,663	116,738

The increase of stock in the new Province of Manitoba is proved by the following figures, and is an apt illustration of the rapid progress of the Great North-West:—

	Cattle.	Sheep.	Pigs.
1884 . .	64,011	6,431	44,901
1885 . .	86,315	9,787	61,907
1886 . .	87,390	13,187	58,779

The progress of Canadian meat and dairy exports during the past four years may be gathered from the following table:—

	Cattle.	Sheep.	Butter.	Cheese.
	No.	No.	lb.	lb.
1882 .	62,106	311,669	15,161,839	50,807,049
1883 .	66,396	308,474	8,106,447	58,041,387
1884 .	89,263	304,403	8,075,537	69,755,423
1885 .	144,441	335,207	8,145,310	86,579,834

There has been a steady increase of meat and dairy exports, save butter, which fell off nearly one-half in 1883, and has not since recovered. The singularly rapid development of cattle and cheese exports, in the last two years, proves that the farming of the Dominion is making great strides.

It may also be as well to record the quantity and value of the chief

articles of food which were last year imported to the mother-country by her Colonies :—

Articles.	British Possessions.	
	Quantities. No.	Value. £
Oxen and Bulls	64,542	1,295,988
Cows	5,605	113,506
Calves	169	616
Sheep and Lambs	39,688	80,058
	110,004	1,490,168
	Tons.	
Bacon and Hams	9,940	359,012
Hams	4,317	226,145
Beef, fresh	1,727	89,748
Do. salted	317	13,600
Meat, salted and fresh	16	707
Mutton, fresh	16,905	837,810
Pork, salted (not hams)	276	8,122
Do. fresh	3	151
	33,501	1,525,295
Meat Preserved	10,518	507,315
Butter, &c.	1,970	159,577
Cheese	30,547	1,241,781
Lard	2,259	83,318

Perhaps the most remarkable increment is furnished by the following table of the imports of fresh mutton from Australasia and from all sources :—

	From Australasia.	Total Imports.
	cwt.	cwt.
1882	37,283	188,656
1883	104,714	237,618
1884	303,203	502,374
1885	336,495	571,646

Australasia, which did not send a fifth in 1882, has in the last two years supplied 60 per cent. of the total imports of fresh mutton. This great excess is mainly due to the increased imports of mutton from New Zealand, which were :—

	cwt.		cwt.
1882	15,244	1884	254,069
1883	87,975	1885	296,473

The number of sheep thus imported from New Zealand was raised from less than 9000 in 1882 to nearly half a million in 1885; and in the first half of the present year the number increased to just 360,000.

These large figures will probably surprise many Englishmen, and when the boundless area of our Colonial possessions suitable for the production of these commodities is considered, there seems no reason to doubt the truth of Mr. Tallerman's confident assertion to the London Working Men's Association, "that we may, within the limits of the British Empire, obtain such addition to the home supplies, as to be entirely free from reliance on foreign sources of food." From a totally different standpoint, Major Craigie, in his comprehensive paper on the "Home, Foreign, and Colonial Meat Supply," arrives by carefully-collected statistical facts at precisely the same opinion, for his brief summary thus concludes: "Within the rule of the United British Empire there is therefore stock enough and land enough to secure plentiful supplies of meat without drawing on any foreign nations whatsoever."

If this one fact is properly appreciated by the British public, the Colonial and Indian Exhibition will not have been held in vain; for the more clearly the different portions of the British Empire discern their mutual dependence upon each other, the more closely will the nation be knit together. And if, during the last fifty years, the tide of emigration could have been diverted from foreign countries to our own possessions, and one-fourth of the money which British capitalists have lavished in propping up decaying and military dynasties, had been employed in developing the vast resources of our Colonies, Great Britain, strong, progressive and united as she is to-day, would certainly have been still more closely united, more prosperous and more powerful.

I now proceed to notice in more detail the contributions from the separate Colonies:—

CANADA.—Ontario had such a grand succession of exhibits, and so much has already been said about its cheese, that it might be supposed that that Province sends us the larger part of the Canadian exports. This is not so, for Quebec furnishes quite three-fourths of the cheese sent to England, but Ontario is rapidly increasing her manufacture. The export of cheese from Canada is nearly four times greater than it was ten years ago, and it is worthy of note that this great trade has all been developed within a quarter of a century, for in 1859 the Dominion imported about 860,000 lbs. of cheese, and last year exported 86,000,000 lbs. The Canadian dairy products in the Exhibition and Colonial Market varied so much from week to week, that it was difficult to know when and how to describe them.

At the last inspection there were thirty-six sample lots from cheese factories, and twenty from the butter creameries, all of which were recently imported, and were in excellent condition. There was a grand display of Ontario cheese, exhibited by Mr. Millar, who claims to be the first importer of these cheeses; and Quebec sent a smaller collection, some of which were coloured red, and most of which were of good quality. From Nova Scotia came some tins of condensed milk, which have hitherto found

a ready market in Western Canada, and now hope to secure a sale in the United Kingdom.

Canada stands third on the list of countries which send us live cattle, being only surpassed by the United States and Denmark.

It may be well to remark that whereas the imports of cattle fell off from all countries, that from Canada increased one-eighth last year. The Dominion had no fresh meat in the Colonial Market; but within the Exhibition was a considerable variety of preserved and salted meat. There was one whole hog, and no end of hams and bacon, lard, &c., chiefly from Ontario. These foods are so generally known as articles of everyday consumption in this country, that they need not be specified. "Prime mess beef" from British Columbia was too salt to be relished except on board ship. Among the many good specimens of tinned meats, those of the Aylmer Canning Company from Ontario deserve great praise, while the Golden Crown Packing Company from Halifax, and Clarke's canned meat and tinned soups well represent the Eastern Provinces. The boneless fowls of the Aylmer Canning Company were well prepared and delicate in flavour, and cannot fail to become a favourite breakfast and luncheon dish in England. "Johnson's fluid beef" from Montreal appears a most perfect form of condensed meat—its extraordinary sustaining powers are well illustrated in Captain Clark, the Agricultural Commissioner from Manitoba, who, being severely wounded in the Riel rebellion, was wholly kept alive for three weeks upon this "essence of beef," and now presents a wonderful specimen of a strong and healthy Canadian.

New Zealand.—The New Zealand fresh mutton made a prominent show in the Colonial Market. The refrigerator was kept at work with its stock of frozen carcases, and they were retailed in joints in great quantities. The price of a whole sheep commenced at 6*d.* per lb.; but gave way fully one halfpenny per lb. before the close of the Exhibition. As previously remarked, the quality of this mutton was excellent, and some idea of the immense import of this fresh meat may be gathered from the fact, that at the time this report was written there were in the port of London 100,000 carcases of mutton in the cool stores and refrigerators of the ships. The market price is now so low, that no profit, but rather a serious loss is likely to accrue to the importers. This large reserve of frozen mutton is sure to keep down the value of ordinary sheep in this country for a considerable period, and may account for the exceptional difference which now prevails in the value of prime down sheep and heavy ewes in the London market; the former selling at 9*d.*, and the latter at 6*d.* per lb. If this imported mutton is forced upon the market, it will be sold at a great sacrifice, and will still further depress the value of all large and coarse sheep in England. In addition to fresh mutton, there were several prime joints of New Zealand beef retailed in the Colonial Market. These were evidently the best portions of well-grazed bullocks, and at 7½*d.* per lb. must be really cheap meat. But the mutton seems to stand the severe freezing process better than the beef.

There were sundry specimens of New Zealand cheese in the Exhibition, much of which was injured by its long exposure to the heat and by the ungenial treatment it received, but it still showed some of its original rich flavour and good quality. The hams and bacon also suffered from a like

cause. There were such animal refuse as tallow, neat's-foot and trotter oil, bone dust, &c., which were well manufactured and preserved in excellent condition. And then there was a goodly array of tinned meats and soups shown by Messrs. Mitchell and Richards, the New Zealand Frozen Meat Company, the Gear Meat Preserving Company, the Wellington Company, and Messrs. R. and W. Hellaby. Some of these meats were somewhat dry, and others a little over-cooked, and a portion of the corned beef was coarse and stringy. But the great bulk was very good; the sheep tongues were delicate, and the ox tongues capital, quite equal to many that are cured in this country.

The soups were excellent, especially the ox-tail, but there seems to be no necessity for proving it to be *real* ox-tail by retaining such a large quantity of big bones as some of the tins contained.

NEW SOUTH WALES cheese is mostly sold in the Colony, and there fetches 4*d.* to 5*d.* per lb. Fresh butter also sells at about 10*d.* So there is no inducement to send either of these dairy products to England. The cheese and butter from New South Wales were both injured by long exposure in the Exhibition. The butter had not been packed to resist the hardships it had to undergo, and therefore had turned rancid. The cheeses were very fair, and some of the smaller ones really good. There was a great variety of make and quality. The Sydney Meat Preserving Company, and Messrs. Walsh, Elliott and Rennie (described as graziers, farmers, and meat preservers), had endless varieties of preserved meat and soups, including such delicacies as stewed kidneys, sheep's tongues, beef and pork sausages, &c. The soups and Irish stews were really prime, but the vegetables could be added more cheaply in this country. The minced mutton was excellent, and it would be difficult to surpass the extract of meat, which seems to contain all the virtues of real Liebig without some of its burnt flavour. New South Wales also showed sundry specimens of tallow, bone dust, neat's-foot and trotter oils.

VICTORIA produces much butter and cheese, which beyond the home consumption is exported to the neighbouring Colonies and to India. The dairy produce of Victoria was mostly sold in the Colonial Market before the time for inspection arrived. The preserved meats of the Melbourne and Western Companies were mainly remarkable for the great variety of tinned rabbit—plain boiled, curried, and with onions—all capital eating, but some a trifle too salt. Mr. Longmore's mince-meat would be much prized in many English households if sold at a reasonable cost. In fresh mutton, Victoria has also contributed to our meat supply. The few sheep carcases from Victoria, which were sold in the Colonial Market, were very excellent mutton, and appeared almost as well bred as those from New Zealand. The two-year-old cross-bred sheep which were weighed during the inspection scaled over 70 lbs., a great advance on the importation of previous years, when 40 lbs. was the more common weight. This Victorian mutton has commanded as much as 8*d.* per lb. in the London market. It is now selling at 4*d.* and even less. If the former prices did not realise a magnificent profit, the rates now current must entail a serious loss. Some idea of the magnitude of this trade in fresh meat may be formed from the

fact, that the Melbourne Refrigerating Company ship about 100,000 frozen sheep per annum to this country.

SOUTH AUSTRALIA.—The meat exhibits of South Australia were mainly confined to a few tierces of corned beef, and cases of preserved meat, two barrels of salt pork, and twenty-four mutton hams. These are mostly used for shipping, and may be useful where fresh meat is unattainable, but are too hard and salt to find favour in this country.

QUEENSLAND.—A little Queensland fresh beef came under observation in the Colonial Market. It was capital meat, well grazed and nicely prepared for export. When cooked, it was full of gravy and retained its flavour, but it speedily loses its colour and freshness after thawing, and wants cooking at once. Like all frozen meats, it was not so good when hashed or served a second time, or so nice cold as fresh-slain beef. Years ago, beef in Queensland which sold at 8*s.* 4*d.* per 100 lbs. has recently doubled in value, and the price must be reduced if the trade in frozen beef is to yield much profit. The Central Queensland and Hogarth Meat Preserving Companies had a splendid assortment of tinned meats. The prime joints of beef which are mostly used, are very superior to the tinned meats of America, the ox tongues are capital, and the soups really excellent. The briskets, sirloins, and rounds of the Central Queensland Company are quite a speciality—they are solid joints of beef without bone, and are much more like home-cooked meat, than any other form of preserved meats. Boiled beef was most general, but now pressed, or corned, or other beef that can be cut down solid is most in favour. Briskets are preferred for pressed beef, and are excellent for the breakfast table, and might with advantage be more used for that purpose in this country, as this is a portion of the bullock that sells at a very low rate in the open market, and is especially adapted for corned beef.

WESTERN AUSTRALIA.—The hams from Western Australia did not keep well, and its only other meat product was a cask of salt beef from Mr. John Liddelow of Perth. This meat was a portion of a grand bullock which took the prize at the Western Australian Agricultural Show last year, and weighed dead 1656 lbs. It was well-fatted prime beef, but as it had been just twelve months in the cask before it was cooked, it was too highly salted for home consumption.

I cannot conclude my report without recording my hearty thanks to all the representatives of the different Colonies, for the readiness with which they answered all my queries, the facilities they afforded me to make my inspection, and the numerous specimens, which required testing, that were liberally placed at my disposal. And I must also acknowledge the great assistance I received from Mr. Daniel Tallerman, the energetic manager of the Colonial Market, who certainly has done more than any man in the Exhibition to popularise the products of the Colonies with the people of this country.

GRAIN.

By W. PROCTOR BAKER.

WITH the exception of the striking display made by the Provinces of the Dominion of Canada, whose Grain Trophy was one of the features of the Exhibition, it can scarcely be said that the exhibits of grain in the Colonial and Indian Exhibition had great attractions for the public. It was not that they lacked in variety or in extent, or in richness of illustration of the cereal productions of the Colonies, but simply because barrels or bags or boxes or bottles of samples of corn cannot in the nature of things be expected to excite a general or lively interest among the many. On the other hand, it would have been better if what was displayed had been arranged in such a manner and accompanied by such descriptions and particulars as would have made it easy for those who were in search of definite information to have gained precise and accurate knowledge of what has been accomplished in the grain-growing branch of agriculture in each distinct district of each Colony. It must be confessed that it was disappointing to find that the exhibits had been collected and were arranged without system, and with the exception of a few cases, without any of the information which would give the samples value in the eyes of an inquiring agriculturist. The stand of the Canterbury Agricultural and Pastoral Association in the New Zealand Court was a good example of what is desirable and instructive, as upon it could be seen each sort of grain in sheaf accompanied by full particulars of the crop, seed, yield, soil, and periods of sowing and reaping. It wanted only separate samples in bulk of each sort of grain displayed to render the form of exhibit perfect from a technical point of view. This stand with the suggested addition may well be adopted as a type to be followed in future exhibitions. The consideration of the grain exhibits in the Colonial sections of the Exhibition cannot fail to call forth reflections of the most dissimilar kinds, differing according to the interests of the spectator. Thus, the Colonial may regard them with pride as demonstrating the capability of the soil and climate of the country of his birth or adoption, or of the enterprise or advance in the cultural skill of its settlers: the intending settler will examine them when estimating his prospects in what is to him the land of promise, whether as a producer or as a consumer. Merchants of all consuming and importing countries will search among them for the sorts which may be suitable for the wants of consumers and attractive to buyers in their own countries. The farmer in our country will compare the samples and their qualities with those which he can expect to produce in the treacherous climate of these islands, and be forced to recognize the impossibility of growing at any rate wheat, if not other grains, with profit in competition with the virgin soils and drier climates which serve his Colonial brethren. The landowner, whose misfortune it may be to possess "corn lands," will, by following up the inquiry into the sphere of the cost

of production of grain in the Colonies and the cost of its conveyance to the consumer at home, have the stern fact impressed upon him that the cultivator of his farms, after defraying all the necessary and imperative charges appertaining to the occupation and culture of the land, can have little or nothing left out of its produce wherewith to pay a rental, if he have to sell at the prices which leave a profit to the Colonial grower; while the consuming public will have regarded the display of the agricultural riches of the Colonies with unmixed satisfaction as affording a reliable promise of the continuance to them of the benefit of a cheap loaf.

It is well known that the United Kingdom depends upon foreign and Colonial sources to a large, and, in consequence of the yearly increase in our population and decrease in the area devoted to the cultivation of wheat, to a growing extent, for its supplies of bread. The tables at the end (pp. 127 & 128) (A), showing the totals of the imports into the United Kingdom of wheat (and wheaten flour reckoned as wheat) from various countries and groups of countries for the last fifteen years, and (B) showing the percentage of the whole supply derived from each country or group of countries in each year, are given chiefly to call attention to the extent of our requirements, and to the comparatively small share which our Colonies have hitherto taken in supplying them. These tables bring into prominence the facts, that, while the supply from India has rapidly and enormously increased, and while Australasia has steadily, up to last year, been able to send more and more of her produce, the imports from British North America have actually and relatively diminished, contrary perhaps to expectation when the development of the exports of wheat from the Atlantic ports of the United States is taken into consideration. There can, however, be little doubt that Canada is destined in the near future to command a much larger share of our wheat trade.

Of all grain, there can be no doubt as to the relative as well as actual importance of wheat, providing, as it does, the staff of life for the Anglo-Saxon race. It has been well said, that of all grains "Wheat is King." Its cultivation is pursued in all the temperate climates of the globe, and in our greatest Colonies. It is intrinsically a Colonists' grain: as it is in almost all Colonial attempts at agriculture looked upon as a pioneer crop, and one "that with little labour, and no cultivation, provides the cash with which to construct houses and barns, and build fences, buy ploughs and reapers, and more cheap land." Its cultivation has been so universally practised, that the world's production of wheat in the last few years appears to have outstripped the demands of consumption, and thus its price has fallen to a point lower than any that has been recorded for a century and a quarter. At the recently prevailing prices of 4*s.* per bushel, or 32*s.* per quarter, for wheats of fair quality in the United Kingdom, the culture of wheat for the supply of these islands has become unprofitable, except under conditions which exist in only few countries; and as a large proportion of settlers in our Colonies look to agricultural occupations for their livelihoods, the low value of wheat cannot fail to have an important influence on the volume and direction of the stream of emigration.

The world is now so completely equipped with steamship and telegraphic routes of intercommunication, that any occasional local deficiencies are instantly met by shipments from the cheapest source at the moment, while the surplus production of all countries is focussed in the English market to

supply the consumption of our own people, or for distribution to the ports of Western Europe. Here it is, therefore, that all countries meet in competition, and here must be decided the survival of the fittest in the struggle for our custom. The first effect of this competition has been to demonstrate that the farmers of England, except on the most fertile lands, and in the most favoured situations, cannot produce wheat without loss at the low prices to which the weight of Foreign and Colonial supplies have reduced it; and this, notwithstanding the facts that the home-grown crops are produced close to the door of the consumer, and have not to bear the cost of long railway-journeys and ocean-freights which attach to the Foreign and Colonial supplies, and that agricultural skill has brought up the average yield per acre in England to a higher point than that of any other country. Undoubtedly, a part of the explanation of the cheapness of wheat of Foreign and Colonial origin lies in the fact, that a large proportion of the Foreign and Colonial supplies is derived either from newly-cultivated and unexhausted soils, such as those of Canada, Australasia, the Western States of America, and Brazil; or from India, where labour is cheap; or from Russia, where originally rich, but partially exhausted soils and miserably paid labour are found in combination. That in years to come, the increase of population, the filling up of new lands, and the exhaustion of fertility will equalize matters, is certain; but the immense extent of rich lands in climates fit for the growth of wheat as yet unsettled and uncultivated, will postpone such an event to a period so distant that it is not worth while to attempt to determine it. The question rather of immediate interest in connection with our Colonies is, as to their ability to sustain the competition against all other countries, and for our farmers and consumers, as to how low the price of wheat must descend before its cultivation becomes unprofitable in the most favoured lands. The conditions for the encouragement of corn-growing in the most distant countries for the supply of Europe can scarcely be more favourable than of late, when the competition for traffic among the railways of America has been most keen, and the rates of freight consequently unprecedently low, and when it is notorious that ocean-freights have been brought to a point ruinous for shipowners. When, for instance, it is stated that for many months grain has been brought from New York to Liverpool at an average rate of *2d.* per bushel (and even less), about the same as suffices to carry it only about seventy miles inland from the latter port, it can be seen that circumstances can scarcely have been more favourable to the Foreign and Colonial producer for obtaining the highest net price at his own farm, comparatively with the price paid by the consumer. Another point in favour of the occupier of new rich lands under a suitable climate must be observed: viz., that the character or quality of the grain produced on them, as a rule, far surpasses that of the grain grown on lands long cultivated and highly manured in order to force from them a large yield. This very manuring is one of the largest elements of the cost of agriculture in old countries and on exhausted land, when compared with the mode of cultivation of farmers on the rich virgin soils of new countries. Again, the operations of agriculture in these new rich lands are in themselves so simple and comparatively inexpensive, partly from the character of the soil, partly from the dryness of the climate in the countries most favourable to wheat-growing, that the cost of cultivation is reduced to a minimum. In entering on land, either by free

grant, or costing, in comparison with old countries, a mere nominal sum, whether by way of purchase or by way of rental, and on land that possesses in itself a richness of fertility that affords food for a long series of crops without the addition of manure before it approaches exhaustion, the cultivator avoids two of the more serious items of the cost of a crop. Settlers are, in point of fact, engaged in converting these stores of fertility contained in the soil into marketable produce in the cheapest manner, without regard to the future. Of the extravagance and wastefulness of the system there can be no doubt; but the only question which intending settlers ask themselves is, whether or not the industry pays—or in other words, whether or not he can get a living out of it. Some of our Colonies can sell wheat in England, even at the low rates current, and yet make a profit; others cannot. The examination of the products exhibited and of the condition of grain-growing in the Colonies in turn will assist in making the distinction.

CANADA.

Canada, the Colony of oldest foundation, claims the precedence in the examination of her products. In the cereal products of this vast country, extending from the Atlantic to the Pacific, the greatest variety is observable, while examples of all sorts of grain of the highest merit are to be found among the exhibits. It is difficult to measure the exact importance to the Dominion of cereals as articles of export, because returns are not available which in all grain discriminate between Canadian produce and that of the United States which has been passed through Canada in transit for shipment; and again, because Canada imports at some points of her vast territory grain for local consumption, while she is exporting the same sort of grain from other points; the net results, however, in the case of wheat, have been set forth in a table published in the "Canadian Handbook," p. 129, from which it appears that the balance of export of wheat and flour has not in any year reached a large total, and amounts on the average of eleven years to only about 430,000 quarters per annum; the consumption of Canada has been calculated to be at the rate of 4·70 bushels per head of the population, and the estimated yield of wheat is apparently 0·78 bushel per head per annum more than the consumption. As will hereafter appear in considering the provinces in detail, there can be no doubt that the development of the resources of Manitoba and the North-West Territories will, in a very few years' time, enormously increase the exports of wheat from Canada.

The only grain imported in excess of the exports is maize, so that the home consumption of that grain is in excess of the production. It is a grain which rejoices in rich and moist soils, and demands strong heat for its successful growth and ripening, and it is produced in great abundance in all countries affording these conditions. There are many varieties of this grain, and some of these are cultivated in Canada, where the warm summer suits it, provided that the ripening can be accomplished before the autumn frosts occur: established varieties exist suited to a summer so

short even as three months. But as a crop it has by no means the prominent place in Canadian agriculture which it holds in the United States, where it is by far the most considerable of the cereal crops. It is most useful, for it is food for man and food for beasts of all kinds: horses, cattle, sheep, pigs, dogs, poultry, alike consume it. Yet it demands a rich, natural soil or generous treatment, and this is not often afforded under the Canadian system of farming, the tendency of which hitherto has been to exhaust the soils; and until stock-raising and dairy-farming, in which the Canadian farmers are now generally embarking, are more extended, the production of maize, even of the sorts appropriate to the climate and in the districts fitted for it, cannot be looked for on a large scale. It is a crop yielding a great weight of grain, while the stalks are good feed. In this country we appreciate it but little as an article of human diet, the largest consumption of it by man being in certain districts in the south and west of Ireland, where its use became established at the period of the potato famine. Beyond its limited use in the manufactured form of "maizena" or "corn flour," it is seldom used for human food in Great Britain. In fact, the art of making bread from Indian corn is unknown on this side of the Atlantic. Cold corn-pudding, hot corn-cakes, pop or parched corn, and a variety of dishes, of which the names are strange to our ears, find their place in the dietary of all classes in America and Canada. The use of corn in the green state as a vegetable is large. In dry summers the green plant is used as forage, while the dried sheathes of the ears have their uses in stuffing beds and pillows, for which they are a clean, sweet, and elastic material. Canada cannot but considerably extend the cultivation of this grain, so useful to the Colonist depending upon the resources of his farm, in districts favourable to its growth, when farming shall have entered on a system more provident for the future. Oats and pease are staple products of the Dominion, and "Canadian oats" are a type well known at the antipodes. Oats are most extensively used in the form of oatmeal as human food. In bulk, oats form by far the largest crop of the Eastern provinces. Rye, beans and buckwheat figure in the list, but only for small quantities. Barley is grown largely for export to the United States for use in the breweries.

In so vast a country as Canada, it is necessary to deal with the provinces and their produce in detail, as each province has its distinctive features. NOVA SCOTIA, as the first province met with on approaching Canada from the Atlantic, has the first claim to attention, as well on this as on another ground, namely, that it was in Nova Scotia in 1605 that "the first actual settlement of Europeans within the boundaries of the present Dominion of Canada was made," and there (at the present Annapolis Royal) "the first field of wheat ever sown by the hands of white men in all Canada was sown—winter wheat it was, for Poutrincourt says 'it grew under the snow.'" Nova Scotia appears as an exhibitor of winter wheat, spring wheat, winter rye, white and black oats, buckwheat, barley, beans, and Indian corn. The climate of Nova Scotia is more inclined to be damp than dry, and therefore better adapted for green and root crops than for cereals which require a dry atmosphere to bring them to perfection. Of the grain crops, as may be expected from the climate, there are more oats grown than of all the other grain crops together, and in this province

maize is found in very small quantities. Wheat at the period between 1860 and 1870 suffered so much from the attacks of weevil that its cultivation almost ceased, and even now that it has been long revived and has nearly doubled in extent the produce of the harvest of 1871, it probably does not reach beyond from one-third to one-fourth of the needs of the population. In fact, other considerations apart, the people do not apply themselves to farming in a persistent spirit, their occupations being rather those connected with the forest, mining, and maritime pursuits; while among the farmers grain-growing has no attraction, because they find in grass lands, and potato and fruit cultivation, far better remuneration for their labours. The grains of the province are well illustrated at the Exhibition, but none of the products are sufficiently remarkable to require comment.

PRINCE EDWARD ISLAND, situate on the south side of the Gulf of St. Lawrence, is only about 130 miles long and about 34 miles wide, but it exceeded in its produce of both wheat and oats at the time of the last census those of the Province of New Brunswick. There were to be found in the Exhibition samples of white and red wheat, barley, black and white oats, Indian corn, and buckwheat. As may be expected from the situation of the Island, and from the configuration of its surface, which is hill and dale, and marked by many streams and rivers, oats have been found to be the most suitable and successful crop; they ripen well, and in good seasons are sent to this country in considerable quantities. The oats shown are distinguished by their intense blackness. The barleys are coarse and poor.

NEW BRUNSWICK cannot be destined to play a conspicuous part in growing grain. An immense proportion of the surface of the province is covered with timber, and this timber must be cleared away before the soil becomes available for agricultural purposes. It is supposed that the timber felled about pays the cost of clearing the land; but even if that be so, and if the new settler have the necessary strength, experience and skill for the work, yet he would scarcely choose land that has to be thus cleared when he has the opportunity of occupying lands of far greater richness immediately available for tillage in the prairies of the West.

The noted "intervale" lands of the province which lie on the banks of the rivers, and stretch sometimes for miles to the foot of the hills, owe their richness to the deposit laid upon them each spring by the overflow of the rivers. But these are grazing rather than corn lands, and much increase in the cultivation of grain is not to be expected. In New Brunswick, in the last decade, the increase of all lands under cultivation was only 7 per cent. The Department of Agriculture of the New Brunswick Provincial Government has collected a very instructive series of samples, and the specific weight of the grain, as well as the yield per acre, are given in the Catalogue. These weights and yields are in all cases good, and in some cases very high; the quality of the samples must, however, be very exceptional, as, taking wheat for instance, while of the samples exhibited a yield of 30 to 35 bushels per acre is recorded, the average of the province at the last census of 1881 was only 13 bushels of this grain per acre. Oats are more successful in quality than the other grain, and some of the white oats shown are of exceptional merit, weighing 50 to 52 lbs. to the bushel; others are of

ordinary quality, while the black oats are similar to the well-known Prince Edward Island type. The barley, with the exception of one fine sample, is coarse and poor. Indian corn does not appear. A sample of Manitoba Fyfe wheat is interesting as showing how this wheat degenerates when grown on other soils and in other climates than those of the North-West. It is to be regretted that the collection of samples was not kept together, instead of being more or less scattered among the Canadian grain exhibits.

QUEBEC is a province distinguished by its backwardness in agriculture, though it ranks next to Ontario in the extent of land under cultivation, and has considerably more than all the other provinces together of such land, leaving Ontario out. Oats are its chief crop, and of these the produce in 1881 was nearly 20 millions of bushels. The general run of the exhibits were of poor, thin white oats, but a few samples of excellent quality and of weight up to 48 lbs. per bushel were shown, while some black oats were of good grain and of a very bright black colour. The barleys indicate from their appearance that they grew in a damp climate, and their distinctive characteristics are coarseness and poor colour. The weights are very light. Red Fyfe wheat has also been tried in Quebec, and the samples exhibit the marked deterioration of quality observed in New Brunswick.

ONTARIO well sustains its claim to be the premier province of Canada, as in other departments, so in the extent of its produce of grain. It certainly so far takes the lead in the farming operations of the Dominion. With a population now amounting to about 2 millions, it has a territory with an area of nearly 200,000 square miles. Ontario has been called the garden of the Dominion. But the fertile district on which rests the claim to this name is the land skirting the northern shores of Lake Ontario and Lake Erie, "which rises gradually to a water-shed 600 feet above the lakes, and distant 70 miles on an average." This belt of 15,000,000 acres is the garden of Ontario. Consisting originally in great part of forest, which has been cleared to make way for the farmer's operations, tree-stumps remain as memorials of the clearing, all of which has been effected within about half-a-century, and the great difficulty of farming now is to get rid of these stumps and roots. Here, as elsewhere, wheat was used as the pioneer crop, and much of the land has been used up by constant cropping, and has become wheat-sick. Of this, some has been abandoned, while some by more skilful treatment has been made to yield up its unexhausted fertility by a wiser system of cropping. Mixed agriculture is extending, and grain-growing is no longer solely relied upon, stock and dairy-farming partly taking its place. The number of samples exhibited from this fruitful region was not great, but the range covered by the specimens is a wide one, and they were fairly representative. The wheats may be classed as white wheat, red winter wheat, and spring wheat (red). The characteristics of all these wheats may be said to be the comparative largeness of the berries and their mellow softness. They evidently lack in point of the "strength" demanded by modern requirements, and if the farmers desire to obtain a full value for their produce, they must take notice of the competition of the Manitoban wheats, and endeavour to find sorts that will hold their ground in the markets by the side of those wheats. The great local millers are said already to show their preference for the Western wheats,

and by using them to find the means of meeting the competition of the highest quality of American flours in the Canadian markets.

In point of produce the results recorded in Ontario by the Bureau of Industries are good, and exceed those obtained in eight of the principal wheat-growing States of the United States, for the four years during which returns have been obtained; and as the cost of cultivation may be assumed to be about equal, it is obvious that the larger yield per acre gives Ontario the greater attraction for farmers, and enables them, while obtaining equal returns for their capital and labour, to undersell their neighbours in the States. The acreage and yield of wheat per acre in Ontario are as follows :—

	Winter Wheat.		Spring Wheat.	
	Acreage.	Yield.	Acreage.	Yield.
1882	1,188,520	26·3	586,817	16·5
1883	1,091,467	10·6	586,410	16·6
1884	864,740	24·0	721,647	20·2
1885	875,136	24·5	799,463	11·4
	Average yield 21·1 bushels per acre.		Average yield 16·2 bushels per acre.	

The samples of barley are very various in quality; barley is grown on an acreage in extent about half of that under wheat. There are fine bright sorts of white colour but somewhat thin, admirably adapted for brewing purposes, and these find an advantageous market in the United States, which take six-sevenths of the barleys exported from Canada, preferring them to the home-grown, notwithstanding the enhancement of price by a high duty on importation. The inferior descriptions are of coarse uneven quality, adapted for animal food. Thirty to forty bushels per acre is not an unusual crop, and the average yield of the province is twenty-seven bushels.

Oats give by far the largest bulk of any of the grain-crops, and about seven millions of quarters of this grain were produced in each of the last two years on about 1½ million acres of land. The average annual yield per acre has been 37·4 bushels for the last four years. The oats are generally thin in body, somewhat thick-skinned, and light in weight. A few samples were shown of exceptionally fine quality, weighing 45 lbs. per bushel. One sample named White Surprise was a splendid specimen. Oatmeal is largely consumed by the inhabitants of Canada, and the exports of oats, though constant, are not of great moment.

Pease are one of the great staple crops of Ontario, but their cultivation has been limited in consequence of the attacks of the pea-bug during the last twenty-five years. This pest has apparently disappeared since 1884, and the crop may be expected to increase in favour. The quality of some of the exhibits is superb, and various grades are shown, down to the ordinary samples of the pease of commerce of which the bulk of the crop consists. 1¾ million quarters were grown in 1885, and the average yield per acre is 21·3 bushels.

Maize is shown chiefly in cobs. It is used largely as green fodder, and its importance as a green crop in a country where good natural pastures are wanting is great, as it affords a supply of green food at the end of summer when the grasses are gone, and as a fattening saccharine fodder it is much appreciated. The acreage however is insignificant and diminishing: it is

only 167,831 acres. A large number of varieties were shown, but it is evident that it is not a grain that flourishes well in the climate and under the conditions of farming in Ontario.

Rye, buckwheat, excellent haricot and other beans were among the exhibits, but horse beans appeared to be wanting.

Ontario has now entered on the stage of a settled country, and as all its uncultivated lands are occupied by forests, and require to be cleared before they are adapted for tillage, it has a rival in attraction to pioneer settlers in the Western Provinces, where prairie lands of unheard-of fertility await the labours of the farmer, and lie ready for the plough without the preliminary and necessarily slow process of clearing away the timber. The demand for timber from the United States, the pine forests of whose North-Eastern States are being depleted, ensures the continuance of the work of cutting the forests and the consequent spread of the farming industry. "The lumbermen are the pioneers who have opened up Canada," and the lumberman developes into the farmer, While thus for the sake of the timber a constant moderate addition to the cultivated lands of Ontario may take place, yet its future must be looked for in the improvement and completion of its system of farming and in the increase of stock-raising and dairying industries, in which spheres its agriculturalists have already achieved great successes. Statistics make it clear that Ontario is year by year dependent less on grain-culture, which nevertheless will always hold a large proportional place in the systems of mixed farming, which are rapidly gaining ground. Its farmers are hardy, laborious, and thrifty, and imbued with an enterprising spirit: many of them are moving to the west, seeking to better their fortunes in the prairie lands, and thus they make room for emigrant farmers possessing capital, who, guided only by their experience of old countries, are only too glad of the opportunity of beginning their life in a new one by entering upon lands already in working order. These old settlers who are moving on find no attraction in the northern or western parts of Ontario, and as new-comers of enterprise would certainly prefer prairie-farming to clearing forest land, no great extension of grain production can be looked for in Ontario.

The next district to claim attention comprises the PROVINCE OF MANITOBA AND THE NORTH-WEST TERRITORIES, which have been brought recently into commercial relationship with the world by the construction of the Canadian Pacific Railway. It is in this region of Canada that may be expected an enormous development of grain-growing, especially wheat, oats, and barley.

But before reaching this vast country, in passing westwards after leaving the well-cultivated and fruitful region of Ontario, the traveller passes through dreary wastes of rock, scrub timber, and water, until he arrives at Port Arthur: this is a settled district, of which the soil is said to be good, and its produce in grain was well illustrated in the Exhibition: not much however can be said in praise of the quality of the exhibits. Another desolate and sterile tract of country is interposed between Port Arthur and Manitoba. Manitoba promises to be, under cultivation, one of the most prolific territories of the world. There are varieties of soil, both in Manitoba and in the adjoining Territories of the North-West, but the extent of very rich prairie soil made up of, and the accumulation of, the "residue of ages of

previous vegetation" is, and will be for many a long year, practically illimitable. There is an immense area of soil unsurpassed in quality, consisting of black vegetable mould lying upon alluvial deposit: this mould varies in depth from 12 or 15 inches to 2 or 3 feet. It is already covered by a crop valuable to the settler, namely prairie-grass. The condition of the soil is so singular, and the mode of culture so easy that it is held out as an attraction to settlers that no previous experience in farming is required for success in cultivating these rich lands. This is, no doubt, to a certain extent true, but it has already become obvious, that after the first few crops experience in farming will tell its tale. Yet while land is offered practically free to all comers, it is certain that strong men, bold in their ignorance, who can carry on the simple cultural operations required regardless of the future, will settle there. As it is probably the country where wheat can be grown, so long as the fertility of the soil is unexhausted, more cheaply than in any other in the world, and of a quality that is incomparable for excellence of its own type; and as the country is served by a railway that is expanding its system throughout the territory, and is able to carry the products of the region to the seaboard, so that there is no difficulty as to markets, it will attract settlers in larger numbers than any other agricultural Colony, especially as it can be shown that even at the present low prices of grain, a profit on its cultivation is to be made. The region has its drawbacks in the variation of the temperature from 100° Fahr. in summer to 40° below zero in the winter, yet the cold does not appear to be felt to anything like the extent which the reading of the thermometer would indicate, on account of the absolute dryness of the atmosphere. The universal testimony of the inhabitants is that their health does not suffer, nor are there the complaints that may be expected of discomforts. The settlement of the region has passed out of the stage of experiment of the ability of men and women to endure the rigours of the climate, as well as of doubt about the quality of grain-crops, or of their prolific yield, or of the cheapness of culture. The distinctive feature of agriculture is that there are no winter crops; whatever is grown must be planted after the soil is liberated from frost in the spring and ripened and gathered during the summer. In the winter the land is frost-bound to the depth of 3 or 4 feet, and is thus in absolute rest: whether this rest has anything to do with the marvellously rapid growth of vegetation in the summer, as is asserted, is perhaps doubtful; but the thorough disintegration of the soil effected by the frost is of the utmost importance and value in fitting it to receive the seed. Land in this region ploughed in the autumn is found quite friable in the spring and in an inconceivably tender state. Yet the frost is so intense that no grain-plants can live under it, and thus autumn sowing of any and all kinds of crops is impracticable. As the winters are cold, so are the summers hot, and the high temperature is all important, not only in ripening, but in thoroughly drying the grain-crops. Unless these crops were thoroughly dried, they would be wanting in one chief element of their value, nor would they be able to bear transportation for long distances. It is often the want of dryness, the lack of condition, which tells against the availability of the wheats of Ontario for shipment. But the summer has also the advantage of the alternation of hot days with cold nights, which seems to suit the hardier grain-crops most perfectly. Maize, however, cannot be grown. Root-crops of enormous bulk and excellent quality are produced in this prolific soil, being served by the

supply of moisture given up from below as the thaw gradually proceeds downwards, and the thaw is not complete until the month of June.

The land on which the settler enters has the advantage to him of already carrying a valuable crop, the crop of prairie-grass. This prairie-grass is so thoroughly acclimatised that nothing appears to be able to destroy its vitality. It is said that if the prairie sod be broken up, and that after a crop has been taken off the broken ground be abandoned, the fertility of the soil is so great that weeds of the strangest types grow rampant and completely cover the ground; yet if it be left for eight or ten years the prairie-grass will have dominated the weeds and asserted its right to the soil, of which it will be found to be in complete possession, having choked and strangled the weed growth. This prairie-grass supplies ready to hand the fodder for the oxen which the new settler employs to work his land. The crop is as much as 2 tons per acre, and it costs about 4*s.* per ton to cut and carry, for it dries as rapidly as it is cut. At the outside, 3 tons per head of stock will carry them through the winter, so that they cost in keep a mere nothing during the idle period. As the settler gets his farm under cultivation he can grow oats which yield a heavy burden of grain, and then he will be able to replace his oxen with horses, as he will have a supply of the needful keep for them. The new settler thus finds a provision of fodder for his working animals ready for him.

It may appear at first sight that a new settler arriving in the spring may at once proceed to get a certain amount of land under a crop to be gathered in the autumn, and it is quite possible that this may be accomplished, but experience has shown that this course is not wise. The better plan is to turn over the prairie sod with the plough, so that the mass of roots of the grass and the weeds may be thoroughly exposed and rotted. The surface is then returned to its original position, an operation which is termed "backsetting." The original breaking and subsequent "backsetting" may be accomplished in the first summer, and the first sowing in the following spring. Linseed has been tried on freshly-broken land without "backsetting" and found to succeed well, yielding a crop of about 15 bushels per acre, and oats have been tried with partial success; but men of experience agree that if the sod be not well rotted by "breaking and backsetting" subsequent crops suffer, as the grass and weeds assert themselves to the great detriment of the grain-crops. There is another objection to the attempt to raise a crop the first year, namely, the late period at which of necessity it must be sown, *i.e.*, after the arrival of the new comer, which cannot take place until the frost has lost its grip of the country, and then not until he has provided shelter for himself and family and his stock, so that it must be late before he begins to plough. As will hereafter be shown, early sowing is imperative, and as settlers require for their sustenance to get immediate returns for their labours, it would appear to be advisable in order to develop the country rapidly that farms should be laid out, a certain proportion of their area being prepared for cropping, and a house and shelter for stock erected thereon, by public organisation or by private enterprise, so that a settler may be enabled in the year of his arrival in the Colony to plant seed and obtain a crop. As matters stand, the want of capital among settlers is a great drawback to the progress of cultivation, and any arrangement that would enable men to enter on land ready for cropping and equipped with a habitation on terms of gradual

repayment of the outlay would help forward a rapid settlement of the country. It has been conclusively demonstrated by experience that the crop cannot be sown too early. So soon as the frost has disappeared from the ground to the depth of 2 inches the seed ought to go in; for the reason that the earlier it is planted the earlier will the crop be fit to cut, and thus the more likely to avoid the early autumn frosts, which are most destructive to the value of the produce. In 1883 and in 1885 early frosts wrought much damage to the wheat-crop. In the latter year there was a frost of 7 or 8 degrees on the 24th August, while the wheat was still green. In 1886 the wheat was already cut in the first week of August. The frost of 1885 was by no means universal. It appeared to run in "streaks": thus one man's crop was much damaged, while his neighbour's was untouched; a part of a field was injured, while the remainder of it was unhurt. Across some fields it ran in lines parallel to the boundaries, in others in lines in a diagonal direction. In all cases it was worse in damp low-lying districts. The mischief wrought was very serious; some wheat was fit only for pig food; some sold at a greatly depreciated price, and some at only a slight reduction. Some farmers did not reap the crop, and one instance is recorded of about 1000 acres being burned as it stood, to save the cost of harvesting. But these frosts are said to be quite exceptional and contrary to all the experience of old settlers outside the two named years. The frost of 1885 is said to have been the earliest known for half-a-century. In estimating the value of the country as a colony which is to rely on grain-growing for its success, the danger of such frosts cannot be disregarded as affecting the average value of the produce. The lesson has been a sharp one, and has thoroughly impressed on settlers the advantage of ploughing their land in the autumn, so as to be able to sow it at the earliest practicable moment in the following spring. The dread even of frost has in past seasons caused much wheat to be cut in an unripe state. It was thought that frosted wheat would have lost its germinating power, but this fear has proved to be groundless, as many farmers had no other seed to sow, and they used it with perfect success. Thick seeding is also recommended, as well as early sowing, as a means of forcing on the crop, because wheat, if it has room, will send up several stalks, and the development of these retards the growth of the plant; whereas if the plants be crowded this tendency is diminished in favour of the more rapid growth of a small number of stalks from each grain.

Next to the frost the greatest trouble to the farmer is with weeds. The extraordinary fertility of the soil forces these into the most astounding growth, if they are not extirpated, subdued and kept under. Stringent laws exist compelling farmers to destroy weeds and appointing officers to carry out the enactments. Wild buckwheat is reported to be most prevalent, whilst "lambs-quarter," Canada thistles, wild mustard, cockle, wild oats, and wild sunflower abound. It has been found that the vigilance displayed has done much good, and these nuisances are in a fair way to be suppressed. The most effectual method of extirpation seems to be to have the land turned up and to allow it to lie fallow every third year. Prairie fires are another source of trouble. These are terrible in their scope, and are perfectly unmanageable, and have destroyed the gathered crops of many a farm, but the cultivation of the soil and the adoption of precautions minimize the source of danger. Such are in brief the conditions of farming in Manitoba

and the North-West. The cost of the cultural operations and of raising a crop of wheat will be dealt with in comparison with that of other countries; suffice it here to say that the cost of raising a bushel of wheat appears to be less here than in any other country of the world.

Of the produce of the region, ample opportunity for forming a judgment is afforded by the specimens exhibited. More than one-fourth of the whole number of the Canadian exhibitors in the Cereal Class came from Manitoba and Assiniboia, and three-fourths of the Manitoba and North-West samples were from Assiniboia; but it should be explained that both the Manitoba Committee's and the Canadian Pacific Railway Company's exhibits appear each under one head in the Catalogue, though each covered a large collection of specimens.

As a whole, the quality of the corn is in every respect excellent. The valuable crop, however, for which the provinces and district will become famous is the wheat-crop, and it may be said that the Red Fyfe wheat grown in this region is as a red wheat adapted to the needs of the modern system of milling by rollers unsurpassed, even if it be equalled, by any wheat in the world. Its dryness, its translucent appearance, its rich amber colour call forth the highest admiration of experts, whilst the known results it gives when reduced to flour, and the large amount and elasticity of the gluten it contains, make it the most valuable of wheats for the miller and the baker. This wheat weighs from 62 to 65 lbs. per bushel in the best examples. The sale for it will be limited only by its production, and it will command the highest price of the day for red wheat, and the best of it a price higher than most white wheats. The development of wheat-growing in the North-West must be in the cultivation of this hard spring wheat, which is grown nowhere else except in Minnesota and Dakota. Its character remains constant when grown in the North-West, but grown in the Eastern Provinces it becomes mellow and loses its valuable properties. There is no doubt that its origin was the Russian Ghirka wheat. Other sorts of wheat appear, named White Fyfe, Golden Drop, White Russian, and Lost Nation, all of which are grown, but on a far smaller area than Red Fyfe. None of these wheats, however, are comparable to Red Fyfe, and it is to the interest of farmers that they should carefully adhere to the true type, and prevent its mixture with or hybridising by any of the softer and less valuable varieties. The "inspection" or grading of these wheats, when dealt with in commerce, has hitherto been rigid and careful, and for the success of future business with this produce it is of the highest importance that there should be no laxity. As to culture, Red Fyfe wheat has the demerit of being appreciably later, and therefore more liable to be frosted than some other varieties; but on the other hand, it is slower to sprout in a wet harvest, and it is asserted to be smut-proof, while all soft varieties are liable to smut.

The extent of land under wheat up to the present time is by no means great, but the increase is steady, though it has been retarded by the Riel rebellion, and the unfavourable seasons. The figures as to acreage and yield given by the Manitoba Department of Agriculture are :—

	Acreage under wheat.	Estimated average yield per acre.
1883	260,842	23·69
1884	307,020	21·84
1885	367,497	20·81
1886	380,231	about 17·00

The drought of 1886 has prevented a very large breadth of land from being broken up, and the quantity of newly-ploughed land is only half of that worked in 1885. The drought which made the land so hard also reduced the yield of the crop, though the quality is very fine. The yields of the wheat-crop ascertained by the Department of Agriculture for the years above given fall short of those of which records, though not officially taken, have been obtained by the Department. These, on the average of the seven previous years, show an average of 29 bushels per acre. It is certain that on the best lands, and with efficient cultivation, 40 bushels per acre have been produced, while on poorer lands, with insufficient ploughing and late seeding, the crop has amounted to only 15 bushels. It is safe, however, following the official records, to reckon on 20 bushels per acre as the average of good and bad lands, in an indifferent year, while in good years higher figures will certainly be reached. It should be mentioned that the straw is burned generally in the engine used for driving the threshing machine, and that the straw grown is more than sufficient to provide the fuel for the threshing. The cost of conveying the grain to the dépôts is light, as horses can draw very heavy loads on the sleighs used in winter for its conveyance. From details that will hereafter be given it will be seen that a price of 50 cents or about 2*s.* per bushel will give a living to the grower, though it must be confessed a frugal living. Even at the lowest prices that have ruled in consuming markets the grower may reckon on realising a somewhat higher figure than this.

Barley, in point of price, is the next crop in importance, but strange to say, a sample of barley from Manitoba could not be found in the collection. Several samples from Assiniboia presented themselves. It is to be regretted that the Manitoban barley could not be seen, as the best of it is described as being of fine quality, so good as to be in much demand for the breweries of Toronto, and for Buffalo, Milwaukie, and other Lager-beer centres of the United States. The fine white colour of these barleys is their attraction. The weight is from 50 to 55 lbs. per bushel, which latter is, however, quite exceptional. The commoner qualities of barley are poor. The returns for barley are as follows :—

	Acreage under barley.	Estimated average yield per acre.
1883	60,281	30·00 bushels.
1884	40,848	32·44 ,,
1885	52,189	29·00 ,,
1886	69,305	probably below 20·00 ,,

10*s.* to 12*s.* per quarter is regarded as a price at which barley will pay its way in average seasons.

The samples of barley from Assiniboia were not good. One from Moosejaw was of good white colour, though somewhat brittle.

Oats grow very heavy crops, in good years up to 50 bushels per acre; but as they will not bear carriage to distant markets are not remunerative to the farmer, except as providing keep for his horses and stock, and for meeting the local demand for oatmeal for human food—15 to 30 cents per bushel, or from 5*s.* to 10*s.* per quarter, are the values quoted, according to the proximity of a town. It is not surprising that the acreage does not increase. In fact, farmers do not systematically grow the grain for sale, but sell only the surplus they may grow after satisfying their own needs.

The records with respect to this crop are :—

	Acreage under oats.	Estimated average yield per acre.
1883	215,431	44·00 bushels.
1884	133,004	39·67 ,,
1885	157,026	40·53 ,,
1886	159,450	probably about 28·00 ,,

The samples of oats displayed show very good quality of grain, leaving nothing to be desired. One lot of very fine black oats yielded 70 bushels per acre of a weight of 42 lbs. per bushel. The best white oats of the province may be expected to weigh 46 lbs. per bushel.

Of other cereals samples are shown, all of excellent quality, but the quantities of these produced are very small. Flax is grown to the extent of 16,473 acres, and has proved itself to be an excellent initial crop on newly-broken land. As 15 bushels per acre can be grown, and it is worth 80 cents per bushel, it fully pays the cost of breaking up the sod. It is worth observing that the names of four Indians appear among the exhibitors.

A general census of the North-West Territories was taken in 1885, and it was found that the following acreage was under crops of grain, viz. :—

67,256	acres, yielding	1,147,124	bushels of	wheat.
11,605	,, ,,	257,479	,,	barley.
35,343	,, ,,	1,045,950	,,	oats.

The total area of land returned as occupied at that date was 3,861,818 acres (of which only 195,985 were cultivated), held by 6,987 occupiers, of whom 6,885 were owners: the total population of the Territories being 48,362.

There can be no doubt that the next few years will see a very large increase of grain production in these regions.

The Province of British Columbia is not an agricultural country, except in a minor degree. Its great riches lie in its minerals and in its forests. There are, however, large tracts of arable land, and the enterprise of its settlers has brought forward forty-one exhibitors, or one-fifth of the whole number of Canadian exhibitors of grain. There are no statistics of production available, but it is evident from the fine quality of many of the samples that the soil is fertile and the climate adapted to the growth of cereals. The wheats are all of white varieties, and are large-berried soft wheats, some being described as grown from Chilian seed; all the wheats are weak. Yet that they occasionally reach great weights is evidenced by two samples which weigh respectively 66¼ lbs. and 66½ lbs. per bushel. No particulars are given of the yield. Looking at the quality of the run of wheats, it is doubtful whether they would bear the voyage to England, or could compete with the wheat of California and Oregon.

Oats of very fine quality were shown, yielding well, viz. 2,600 to 3,000 lbs. per acre.

Barley of every variety was displayed, from the very finest, weighing as much as 60 lbs. per bushel, down to low poor sorts; the feeding barley is of a coarse and black-looking type. Pease of 66 lbs. per bushel were shown, and of admirable colour and shape, and some very pretty pease named "partridge."

Maize was amongst the exhibits, but it appears to be more a garden than a field crop.

As curiosities among the Canadian samples may be mentioned white and black hull-less barleys and skinless oats, but whether there be any advantage attaching to these sorts does not appear.

Turning now to the Colonies in the Southern Hemisphere, the Australian Colonies and New Zealand, acting independently, did not obtain the same prominence for their exhibits of grain as Canada achieved by the happy thought of combining all her provinces in one concentrated effort. Important as is the grain produce of these Colonies, neither exhibit was in a form to arrest attention.

NEW SOUTH WALES.

Taking now the Colonies of the Australian continent in the order of the Exhibition Catalogue, New South Wales holds the first place. It is a Colony not depending on agriculture as its chief resource, and with the exception of Queensland it has less land under tillage, in proportion to its population, than any of the Australian Colonies. Thus, while its population is nearly the same as that of Victoria, it has little more than one-third of the extent of land under cultivation: and while it has three times the population of South Australia, that Colony has more than three times as much land under cultivation. In fact, taking the last ten years, New South Wales has not grown enough grain for its own consumption; maize being the only grain of which the exports have exceeded the imports. The following are the quantities of grain imported and exported in the years 1875 to 1884 inclusive:—

	Imports.	Exports.		
Wheat (bushels) .	6,146,750	429,003	5,717,747	Excess of Imports.
Barley ,, .	607,672	26,751	580,921	
Oats ,, .	4,433,144	97,624	4,433,144	
			10,731,812	
Maize ,, .	520,841	5,720,108	5,199,267	Excess of Exports.

Balance of Imports over Exports of all grain 5,531,545 bushels.

New South Wales may be divided into three regions: namely, the Coast district, which contains the river valleys, well known for their rich lands, whose fertility is traceable to the alluvial soils and rich deposits brought down from the mountain sides by the rapid streams; the Table lands 2000 to 4000 feet above the sea-level, where are found the best wheat-growing lands; and the Great Plains, a district of aridity, with an atmosphere from which no moisture can be condensed, with a soil unsuitable for

grain, and at an immense distance from consumers, fitted, as experience has shown, only for pastoral pursuits. The climate of the country offers one great advantage for the operations of husbandry in that the winters are so genial that land may be constantly kept under crop, and such a crop as lucerne is cut from four to six times in the year in favourable seasons, while two crops of maize may be grown in the year. The government has been anxious to distribute agricultural settlers on the suitable soils up the country, but the land appropriate for grain cultivation is now scarce, as "selectors" have already taken up nearly all the available blocks. The timbered land is the rich land, and it is thickly timbered. The ordinary process of clearing is to ring-bark the trees, then a year afterwards to cut them and grub the roots: thus the land has to be acquired acre by acre. Men must have capital to enter on corn-farming, and men with capital will not enter upon the occupation now that prices are so low. All small farms have to be worked by hand labour, and the cost of labour is very high, the wages that have been paid having been at the rate of 20*s.* per week with rations (or about 10*s.* per week) additional for agricultural labourers. Thus the cost and outgoings are large. On the other hand, the produce of the soil is not great, the average yields being about fifteen bushels per acre for wheat, twenty bushels for barley and oats, and thirty-two bushels for maize. Soils which the dry weather leaves with a depth of six or eight inches of absolute dust are not attractive to corn growers. The quality of the grain, however, that can be produced, as testified by the exhibits, is excellent, and the yields and weights of grain given by the exhibitors are exceptionally good. The principal sorts of wheat grown are the White Lammas, White Tuscan, and Red Lammas. The highest definite yield given by any exhibitor is forty-nine bushels per acre, and the highest weight per bushel is 68½ lbs. But in the majority of cases of the samples exhibited the yield is stated to be about thirty bushels per acre. The Tuscan White is a long-berried good wheat, while the White Lammas appears to be exceptionally strong for a white wheat. The Red Lammas is of a fine rich, even, clear colour, with berries of good full shape, and far excels in appearance this type of wheat as grown in England.

The barleys are very good in quality and well adapted for malting, so that it can well be produced, yet there are large imports of this grain.

Oats are grown very largely as a hay crop, and those exhibited are somewhat thin. This grain is imported to a considerable extent, even from America. The skinless varieties of barley and oats are also found here, but what may be the advantage of employing them does not appear. Beans are not good in appearance, as the samples had lost all bloom. Buckwheat, extensively used for making cakes, is of fine quality.

Of maize there is a most interesting display, both in grain and in cobs. The acreage under maize has been about half that under wheat of late years. The collection of maize cobs is excellent. The grain is of the yellow, red and white varieties, but all more or less flat, and none of the round sorts. There is here an uncommon variety named Red Spindle, grown as a garden crop, to be eaten green. Several samples were shown of descriptions which are said to develop in ninety days, and of others of which the yield is said to be 100 bushels per acre. Rye of the amazing weight of 68 lbs. per bushel was among the samples.

There is a steady annual increase in the area of land under cultivation

in New South Wales, and having regard to the grain in the Exhibition, it is clear that there is no impediment either in climate or soil to an indefinite extension of the culture of cereals.

VICTORIA.

Victoria is the next Colony in order, and is remarkable for the agricultural progress which it has made especially within the last fifteen years. During that period the land under cultivation has been trebled in extent, and has been increased by 1½ million acres. This fact is in itself evidence sufficient of the fertility of the soil, and of the suitability of the climate for the production of grain. The drawback which is common to all Australia —the want of moisture—exists also in Victoria, but the energy of the Colony is prepared to cope with the difficulty, and irrigation on a large scale is to be provided, experiments having already shown the large gains to be derived from its adoption. It is expected that several millions sterling will be expended in the course of the next few years, on which outlay an ample return is expected. This system will permit the introduction of great varieties of crops, for which the climate and soil, with the addition of water, are well calculated; but hitherto farmers have been forced to employ themselves almost exclusively in producing large quantities of grain and especially of wheat, which at the current prices of a few years since was a sufficiently profitable business. But at the very moment when prices have fallen to a low point a disaster has fallen on the grain growers of the Colony in the almost total loss of their crops from drought, and in place of exporting, large imports of grain from California and India are required to meet the demands of home consumption. It is however satisfactory to know that the growing crop will, as it is said, yield a considerable surplus for exportation. The average yield per acre of all grain-crops in Victoria is low: namely, wheat 12½ bushels, oats 21 bushels, barley 20 bushels per acre; and as it is obviously a critical question whether at the low scale of price now current, grain will pay the expenses of cultivation, it is the more important that the Colony should adopt every means for the development of other branches of agriculture, so as to support the existing cultivators, and to attract new settlers, and at the same time increase the yield of its grain-crops. The cost of cultivation is, however, very low. The land generally is ready for the plough, and there is very little clearing to be done, for the bulk of the wheat-growing land is open plain. The forest land is deep, rich soil. Setting aside the cost of clearing when it is required, it is probable that wheat can be raised and gathered at a cost of about 25*s.* to 30*s.* per acre, all charges included. Ploughing costs from 7*s.* to 12*s.* per acre, and the crop is harvested by means of the "stripper" at a cost of from 3*s.* to 5*s.* per acre, while the straw is burnt on the ground as it stands. This, however, is the mode adopted only when wheat is still the pioneer crop; but when a more advanced system of farming is adopted, the wheat is reaped, and the straw used for feed for stock. Wheat having been gathered by the stripper is winnowed and bagged on the farms

where dealers buy it, and whence it is delivered to the railways. The counties in which most of the wheat is grown are all within a radius of about 150 miles from Melbourne, the port of shipment for the surplus of the Colony, and the nearest districts are not more than fifty miles distant. These distances are not great, but the rate of carriage is high. The wheat belt lies north of the 37th parallel of latitude, and in Talbot and Dalhousie counties, close to, but south of that line. Those counties which have the greatest extent of land under wheat have almost the poorest yields per acre of any. In the counties which have a high rate of yield the quantity grown is very small, and it is therefore probable that it is produced as a rotation crop, or in some choice lands or well-watered situations. The proportion of the whole cultivated land of the Colony under wheat has amounted in late years to nearly one-half, while oats have occupied 8 per cent., and barley about 2½ per cent.; the remainder being used for fodder crops. The tendency has been towards an increase of the proportion of land used for wheat.

The exports of wheat exceeded the imports for the first time in 1870, and then again in 1873 and 1874. Since 1877, and continuously down to 1885, Victoria has exported regularly, and in some years largely: 1884 being the highest year, when the exports reached upwards of a million quarters. In 1886 imports were again necessary in consequence of the failure of the crops through drought. It cannot be pretended that it would be a remunerative business for farmers in Victoria to supply Europe at the prices of the day, but there seems to be no reason to doubt that Victoria can produce her fine white wheats at least as cheaply as, if not more cheaply than, California, the average yields of the two countries being about alike, and it must be borne in mind that the finer quality of the Australian produce will always give Victoria an advantage in price.

Rust is the disease of the wheat plant most dreaded by farmers, while in some districts rabbits are a trouble, and locusts are mentioned as among the pests. "Rust-proof" wheats are diligently sought for. The Victorian wheats are exclusively white, and it does not appear why some of the strong red wheats of the Northern Hemisphere may not be grown with success. Similar losses from rust were formerly suffered at the Cape, but there are now two sorts of wheat there cultivated which are said to be free from the disease—the Baard and the Dutoit wheat. There seems, however, to be some doubt how far irrigation at the Cape may have prevented rust. Experiments are now being conducted at the Government Experimental Farm in the cultivation of several varieties of wheat, and crops yielding as highly as 40 bushels per acre have been harvested from plots on this farm.

The Victoria cereal exhibits display grains of very fine quality of all sorts, but unfortunately from an accident in transit by which the labels were obliterated, it is impossible to make a detailed report on the several varieties. Undoubtedly the best thing under the circumstances was done by gathering the samples into masses of each sort of grain, and as they are abundant in quantity they are sufficient to make an imposing show. The wheats are all white, of fine quality, and very heavy weights. Excellent barley was exhibited, and a sample of very good malt. It appears that four-fifths of the barley grown in Victoria is fit for malting, and fetches good prices for that purpose, and the yield is upwards of twenty bushels

per acre. The malting barley grown is about enough to supply the wants of the breweries of the Colony without importation. A very small area is planted with maize, but good examples of one variety each of yellow and white is exhibited; 150 bushels of ordinary maize has been obtained from one acre on Gippsland flats, and in the dry climate of the Murray River district, with irrigation, eighty bushels per acre have been grown. Oats are good, though the yield is light in proportion to barley, yet from three to four times the area devoted to barley is sown with oats. It may be mentioned that Victoria grows nearly as many potatoes as all the rest of Australia put together, and next after New Zealand produces the largest bulk of grain.

SOUTH AUSTRALIA.

South Australia stretches across the whole island from south to north. It has upwards of 2¾ millions of acres under cultivation, of which 1¼ million acres have been added within the last ten years. The area fit for growing grain, out of the total enormous area of 578,361,600 acres within the Colony, is comparatively small and cannot be extended, as already in the more northern cultivated districts the rainfall is inadequate and the results precarious. The grain-growing history of the Colony covers only a comparatively brief period. From its foundation in 1836 to 1850 South Australia grew only sufficient and in some years not enough wheat for the supply of the inhabitants. In 1850 the first exports of wheat were made. Since then yearly increasing quantities have been exported up to last year, when there must have been at least 1½ million quarters available for export, of which the United Kingdom received upwards of 900,000 quarters. The drought of last season was most ruinous to the crops of grain, and to all concerned in its production. The drought had never been experienced so far south before.

The conditions of agriculture in the Colony from early days have been unique, and without example in any other country. It was found that the rate of increase of wheat-growing was far greater than that of the supply of labour, and consequently that after the crop had been grown it was impossible to get hands enough to harvest it. The difficulty was increased by the effect of the climate on the grain, as it became dry so quickly that it was shaken out of the ears and thus wasted. It was believed that for this reason the extension of wheat culture could progress very slowly. A Mr. John Ridley in 1845 brought to perfection a machine called a "stripper," which quite revolutionized the feeling with regard to grain-growing, as it completely overcame the obstacles to its indefinite extension so long as appropriate land and a suitable climate could be obtained. The "stripper" is a machine which may be said to reap and at the same time to thresh crops of wheat, barley, or oats, leaving the straw standing on the ground to be burned or otherwise disposed of at leisure. It consists of a box or receptacle on wheels to receive the beaten-out corn, and in the front of the box is placed a row of long teeth, between each pair of which the ears are caught and held while the grain is stripped out by revolving beaters, and

thrown into the box. The machine is drawn by three or four horses, and an acre or somewhat more may be cleared in an hour. When the box is filled the machine is driven to the gathering point in the field, where the box is emptied, and the contents having been winnowed and bagged are ready for delivery to the buyer. The cost of the machine is £50 to £55, and it is estimated that 10,000 of these machines have been made in the Colony. Further progress in the same direction is desired, and the Government have offered a bonus of £4000 for a machine that will reap clean and bag wheat fit for market, but hitherto no such machine has been forthcoming. The machine which will "take the corn from the wheat plant and deliver it from the machine fit for market" has yet to be invented. The cost of "stripping" is estimated at from 3*s.* to 5*s.* per acre, and as the average crop is about eight bushels the operation costs 4½*d.* to 7½*d.* per bushel, while the winnowing and bagging cost 2*d.* to 2½*d.*, or a minimum of 6½*d.* and a maximum of 10*d.* per bushel for the operation of harvesting and threshing. Although the price per acre is low, yet in consequence of the small yield the price per bushel is not so cheap as might be expected in comparison with the cost of about 1*s.* per bushel in England for these operations, including the cost of saving and storing the straw for use. Sowing is accomplished by the use of "seed-sowers," by which it is said that 100 acres per day can be seeded at the cost of about 3*d.* per acre. The "stripper" and "seed-sower" were in the Exhibition. The bags of grain are piled either at the farm or at the railway dépôts, and require no protection from weather. Barns and granaries are unknown. Ploughing costs at the outside 7*s.* to 12*s.* per acre; rolling and harrowing the same as on English farms, but the soil being very friable requires very little working. Ploughing cannot be effected until after the rains, which occur in March and April, as the ground is baked hard in the summer. It is in fact upon the rains occurring regularly in the spring and winter in the south of the Colony that the cultivation of wheat depends, for it would not be possible to grow wheats in those parts of the country which obtain their principal rainfall during the summer and autumn months of the year.

The average yield is low—very low—scarcely eight bushels per acre, taken over a period of twelve years ended in 1884, and during that period no year has reached twelve bushels, while three of the years have been under five bushels. There is no doubt that there is a great deal of slovenly cultivation, an immense extent of land being only scarified, and in some instances only scratched over with harrows, and there is little doubt that if the whole area under wheat were properly ploughed the average yield would be much higher. It is said to be "no uncommon thing for a man who has never had anything to do with husbandry to take up 200 or 300 acres of land, and with the help of one labourer to put the greater part under crop within a year." If this be a correct statement it is obvious that the work must be badly done. Although wheat is grown continuously year after year, yet the recognised better practice is to alternate a year's fallow with each corn-crop. In the south-eastern districts a rotation of English grasses, wheat and potatoes is followed, and of potatoes crops of from nine to thirteen tons per acre are grown, but the grasses are generally too rich for sheep, so that the alternation of wheat and fallow is preferred. Neither is the wasteful practice of burning the straw on the ground so usual as formerly. It is now frequently fed down by sheep, cattle, and

horses, and they do well upon it. It is sometimes mown and stacked with a sprinkling of salt for fodder. When prices of corn were at a higher range and brought a return of 5*s.* per bushel to the farmer, the business was profitable, considering the small capital invested, for the farmers generally were of the ploughman or labourer class, and all that was wanted was money enough to fence the land and construct a house; not much of a house is requisite in that climate; cattle require no protection; and money enough to pay for the implements, cultivation and seed of so much of the land as was brought under crop, and to provide for the expense of living until the proceeds of the crop were available. As the cost of cultivation and harvesting were 25*s.* per acre, the acre bearing eight bushels, would, at 5*s.* per bushel, bring in 40*s.*; but since the fall in prices, when wheat would have to be sold at a price equivalent to less than 3*s.* per bushel on the farm, the crop does not pay, and there is no doubt that great distress exists among the corn-growers, which has been accentuated by the drought of last season. The business does not pay, and no more interest is felt in it; and thus it is that the cereal exhibits of the largest wheat-producing Colony of the Australian group were very small. It is to be regretted that a Colony depending so much on its produce of wheat should have taken so little trouble to exhibit. The samples of wheat shown were of excellent quality, and of exceptionally high weights, varying from 63½ to 67 lbs. per bushel. Maize cannot be grown for want of moisture: some little is grown for fodder by means of irrigation. The climate is too dry for oats, and the plant is grown chiefly for hay. Of barley there is not enough planted to meet the demands of the local brewers. The samples of malting barley were of poor colour, and contained much small grain. One from Kangaroo Island is of large berry, but coarse quality. The examples of grains in the straw from the Experimental Farm near Adelaide were remarkable for the clear bright colour of the heads and of the straw, but the ears and the straw were conspicuously short. One sample named Scotch Wonder appears to be a Rivett wheat of white instead of the usual red colour.

QUEENSLAND.

Queensland is in a very limited sense a grain-producing country. The total area under cultivation reaches only 200,000 acres. The only cereal crop of any importance is maize. For instance, the largest quantity of wheat grown in any one year reached only 26,000 quarters; of oats and barley 5,500 quarters respectively; while even of maize only 200,000 quarters have been obtained in any year. The chief seat of arable farming is the Darling Downs district, and it is not for want of good soil that cereals do not succeed. It is rather a matter of climate, and the great obstacle is the prevalence of "rust." No type of wheat has yet been discovered or developed that is "rust-proof." Experiments are constantly being made with seed from other hot climates. Could this drawback be overcome the samples of wheat exhibited demonstrate the capability of the soil to produce good and abundant crops. So far as accounts have been collected it

appears that rust has reduced the yield of the districts affected by it to the extent on the average of five bushels per acre: thus for eight years the average produce of districts affected with rust was 10·13 bushels per acre while the districts free from rust yielded 15·23 bushels. But the figures do not give any idea of the difference of the intrinsic value of the two sets of crops apart from the quantity. In the year 1883, 57,693 acres are recorded as unproductive on account of rust. In 1884, 3837 acres sown for grain were cut for hay by reason of the disease. The quantity of land sown with grain intended to be used as green food, or cut for hay, is so remarkable a feature to those accustomed only to English farming, that it is worth while to record the facts: the acreage is given under each head:—

	Wheat.		Oats.			Maize.	
—	For Grain.	For Hay.	For Grain.	For Hay.	For Green Food.	For Grain.	For Green Food.
1877	8,744	737	74	4,753	1,379	44,718	2,647
1878	10,397	2,114	132	4,772	745	53,709	1,561
1879	13,802	1,197	175	4,430	624	48,365	554
1880	12,631	550	116	3,950	764	44,109	608
1881	10,958	4,574	88	3,983	1,431	46,480	1,060
1882	12,069	2,371	225	6,571	1,253	53,323	1,472
1883	9,974	768	125	5,061	1,576	56,463	1,643
1884	12,105	3,837	143	8,319	1,639	61,064	2,595

For hay, the wheat and oat plants are cut just when the ear is filled, and before the straw loses its green colour. Maize is grown upon the rich alluvial soils of the river banks, and yields heavy crops on the first clearance of the ground. The only specially remarkable sample among the exhibits is one of hard wheat, but this wheat is extremely hard, and of too sharp and brittle a fracture to be commended. Millets and sorghum are grown for fodder and seed. Rice is exhibited, and it has been grown experimentally in the coast districts, but not on a commercial scale, except in one or two instances. Irrigation would be necessary for its success. Queensland is destined to rely on the neighbouring Colonies or on India for much of its bread-stuff supply, unless a rust-proof wheat can be found, which would undoubtedly give an enormous impetus to agriculture in certain districts of the Colony.

WESTERN AUSTRALIA.

Western Australia has very little land under cultivation, the quantity being only about 80,000 acres. Agriculture is confined entirely to the south of the 28th parallel of latitude. To judge from the exhibits, the soil and climate are suitable for the production of wheat, as the samples are of excellent quality and of the same general type as those of the other

Australian Colonies, and have the characteristic bright clear Australian complexion. The average yield per acre does not exceed that of Queensland. The chief producing district appears to be close to Perth, but as there is stated to be abundance of land in the central districts of the Colony suited to the growth of cereals, there seems no reason to doubt that a steady, though perhaps slow, progress may be made in the development of the industry; but at the same time, it is clear that it is not a calling that will be attractive to capitalists, as the returns to be gained for investments in other directions within the Colony are greater, and the settlement of the country will more probably be accomplished by a peasant population. Oats were shown of several varieties: the white sorts are compact, good corn of good weight; but the brown oats are very thin, long-tailed, and by no means attractive specimens of this grain.

The Greenough district, north of Perth, appears to be the oat district. Maize is grown in the Colony, but only to the extent of less than 100 acres.

NEW ZEALAND.

The small collection of samples was extremely well shown, and the collection of soils of twenty kinds with the accompanying analyses printed in the New Zealand Catalogue sent by the School of Agriculture of Canterbury, and the exhibit of cereals and grasses on the stalk contributed by the Agricultural and Pastoral Association of Canterbury, with the particulars accompanying them, deserve to be recorded as examples of the most useful form which such exhibits can take for conveying instruction and information. There is in New Zealand an endless variety of soil, and a great variety of climate, and it appears that by a proper adaptation of means every sort of cereal crop may be grown with great success. The agriculture is of a mixed type, and English systems are more generally approached than in any of the Australian Colonies. The total area under crop (exclusive of grasses) was, in 1885, 1,335,150 acres. Of this total, 106,661 acres were in the North Island, as against 1,223,469 acres in the South Island. The average produce of over 26 bushels per acre of wheat, of over 27 bushels of barley, and of over 32 bushels of oats, demonstrates the fertility of the soil, and places New Zealand in the position of being among the most prolific countries in the world. In addition to the above quantity of cultivated land, New Zealand had in 1884 about five millions of acres under permanent artificial grass. The area under wheat has decreased by about 100,000 acres, or one-third of the extent devoted to that grain, since 1884, showing that the fall in its price had been carried to a point which makes the growth of that grain no longer remunerative, and the occupation of a similar quantity of land has been transferred to barley and oats. A market is found for the surplus of wheat, barley, oats, beans or pease in the Australian Colonies and in the United Kingdom.

The following table gives the particulars, so far as they are stated, of the examples shown in sheaf by the Canterbury Agricultural and Pastoral Association, which are so remarkable as to deserve to be placed on ecord :—

WHEATS.

Description.	Manured or not.	Soil.	Seed per acre in bushels.	Rotation of crop.	Yield in bushels per acre.	Sown.	Cut.
White Tuscan	no manure	—	1¾	after crop of 50 bushels wheat	50	August (Spring)	February
Velvet Chaff	no manure	black alluvial	1½	after potatoes preceded by wheat	50	June (Winter)	February
Purple Straw Tuscan	no manure	—	2	after 2 crops of wheat, 50 bushels each, beans 60 bushels, oats 70 bushels	50 on a 90 acre paddock	September	February
Hunter's Red	—	—	—	—	55	—	—
Essex Rough Chaff	—	clay loam	—	—	50	—	—
Hunter's Red	—	—	—	—	40	—	—
Velvet Chaff	no manure	—	—	—	60	—	—
Tuscan	no manure	—	1½	—	50	October	February
Hunter's Red	no manure	reclaimed swamp	1½	after 2 crops wheat 50 and 60 bushels respectively	65	—	February
White Chaff Velvet	—	—	—	—	50	—	—
Hunter's Red	land never manured	—	—	wheat and beans alternately for 10 years, average of each crop has rarely been under 50 bushels	60	—	—

BARLEY.

Description.	Manured or not.	Soil.	Seed per acre in bushels.	Rotation of crop.	Yield in bushels per acre.	Sown.	Cut.
Carter's Prolific	no manure	—	2	after 1 crop of pease and 3 crops wheat	63.	end of September	early in February
English	no manure	alluvial loam	1½	out of lea, 1 ploughing	60	August	February

OATS.

Description.	Manured or not.	Soil.	Seed per acre in bushels.	Rotation of crop.	Yield in bushels per acre.	Sown.	Cut.
WhiteTartary	no manure	—	—	—	70	—	—
Canadian (stalks upwards of 7 feet high)	—	—	—	—	60	—	—
Sparrowbill	no manure	—	2½	after 2 crops of wheat of 60 bushels	80	August	—
Sparrowbill	no manure	reclaimed swamp	2	after 2 crops of wheat of 45 and 53 bushels, previously grass 9 years	75	October 2nd	February 15th
Sparrowbill	no manure	—	—	after 2 crops of wheat of 40 and 50 bushels	80	October	—
Canadian	no manure	reclaimed swamp	2	—	60	—	—

There were on the same stand some grasses of remarkable growth, viz. :—

Italian Rye Grass, height 9 ft. 4 in. } grown on cleared bush land.
Cocksfoot, „ 9 ft. 0 in. }

Tall Fescue, „ 8 ft. 0 in. gathered within 12 weeks of the paddock being shut up for hay: two previous crops of seed having been taken off: and one cow to the acre running till the paddock was shut up for hay.

Tall Oatlike, „ 6 ft. 3 in. grown on bush land, merely felled and burned off: the seed sown on the surface.

Even if these results have been obtained from selected fields, as they probably were, yet they are sufficient to show wonderful fertility of soil. A large number of other samples were shown, such as Pearl wheat, weighing as much as 66½ lbs., 66 lbs., 65 lbs.; Tuscan wheat, 67 lbs.; Tuscan white, purple straw, 69 lbs. (two examples) and 66 lbs.; Velvet chaff, 67 lbs. These weights show the excellence of the quality. In fact, nothing finer than these wheats has probably ever been seen. The White Velvet and Pearl are both short-berried weak wheats. Wheat grown from White Oregon seed is poor in colour and body. The wheats of commerce which are shipped to England do not approach in quality these fine specimens.

The samples of barley were simply magnificent, and such barleys as the Chevalier would bring enormous prices in England; the best of them are of the white colour, now so much sought after by the pale-ale brewers, while the size of the grain is very large without being coarse, and it is dry and mellow; so far as appearances go there is every indication that these barleys would give the very best results in malting and brewing. If anything like the quality exhibited can be produced in quantity and delivered in England in good condition, a ready market would be found for it, and supposing the produce in beer be equivalent to the appearance of the barley, at very high prices. This year the best of these barleys would be worth 50 per cent. more than wheat by the measured bushel of each. The Golden Melon is a useful brewing barley of large berry but coarse rough skin. New Zealand ships some barley to the United Kingdom, but Victoria and the other Australian Colonies are the chief customers.

In the quality of its oats again, New Zealand is in the front rank. The samples of potato oats are unsurpassable; another variety unfamiliar in England, the "Sparrowbill," is excellent in appearance, with the drawback, apparently, of being clad in a thick skin. The "Canadian" are of superb quality and weight. Long Tartarian, Short Tartarian, and Dun, which are of a grey colour, are grown to perfection. The exports of oats have been on the increase since the decline of wheat, and they are sent chiefly to Australia.

No maize is shown, but all other grains in the collection are of the finest quality.

Whether such splendid grain as is here exhibited is common and can be obtained in quantity is doubtful; but still the fact remains that in all the chief grains New Zealand has shown by these samples a production of superb quality and in prolific quantities. Canterbury and Otago are the districts from which practically the exports have taken place. In the highest year, 1883, the exports of grains were of a value of 1½ million sterling, but her exports of wool in the same year were of just double that amount.

CAPE OF GOOD HOPE.

There are no reliable statistics as to the cereal produce of the Colony, but it seems remarkable that with a soil and climate capable of giving grain so fine as that exhibited, the home consumption should not be

supplied by the home growth, and thus do away with the necessity for large importations. The portions of the country best suited for agriculture are those which obtain periodic and regular rainfall. In this Colony the practice of growing crop after crop of wheat does not obtain. The best land is known by being covered with "Rhenoster" bush, and in bringing land under cultivation it has to be cleared of this. The first crop is one of wheat, which is followed by an oat-crop, and then the land is allowed to be fallow for a year. In old-settled districts, manure is liberally applied. The reason of the insufficiency of the growth of cereals to meet the consumption of the population, is to be found in the high cost of labour for carrying out the cultural operations, coupled with the low yield per acre of the crops. Thus wheat is said to yield only 7½ to 9 bushels per acre, oats about 8 bushels, and barley a much higher but uncertain yield of the Cape variety. English malting sorts do not give good results in quantity. The attractions of Kimberly, or of the gold-fields, carry off the labourers. Not even a protection duty of 5*s.* per quarter encourages production. Railway freights are very high, and this stands in the way of the competition of the home crop with imported grain, though imported grain is charged 50 per cent. more for carriage than the home-grown. Wheat in the past has suffered severely from rust; but it is stated that the Dutoits and Baard sorts resist the disease. The former is of small berry, mellow, firm texture, of the shape familiar in this country as that of Calcutta wheat; the Baard wheat is long-berried, and apparently a strong wheat: both are white and excellent wheats. They are preferred before the Australian wheats with which they are brought into competition by the imports. Good stout white barleys are shown, but the ordinary "Cape barley" is of coarse, poor quality. Oats are chiefly grown for oat-hay, and the samples of this grain are poor. Maize is grown universally, but not in sufficient quantity to meet the home demand, and it is imported largely, even from the Argentine Republic. Many specimens of rye of extremely good quality were exhibited, and excellent hops were shown among the cereals.

NATAL.

Natal sends good illustrative specimens of its cereal products. Maize is the universal crop, and is grown at all elevations and in all districts of the country; it is the "mealie," the food of the native, and in general use for all purposes by the settlers. The quality of the samples is generally excellent, of large size in grain, and good in colour, and they may be roughly divided into white, yellow, and red varieties. The finest maize is grown in the coast districts. The crop is now so extensively cultivated, that the supply is more than enough for home consumption, and a considerable quantity will be available for export. The yield is estimated at from 18 to 35 bushels per acre. All wheat is grown on high-lying ground, from 2000 feet elevation and upwards, averaging 3000 feet, but it is not an industry of importance, and it is grown chiefly for local consumption. The samples shown are poor: the white is of a dull muddy colour; while

the red can be described only as of very bad quality and out of condition. Unless better qualities can be produced, the home supply cannot compete with Australian. Barley is said to grow well in the Colony; but of the samples shown, one only can be described as being of fair quality, the others are middling or bad. Oats are grown for hay. Good rice is shown, and not quite enough of it for the home demand is produced.

Sorghum, known in the Colony as Kafir corn, is largely grown by the Kafirs in all parts. It is used chiefly for the production of native beer. Red and white varieties are displayed. Pease and beans of several varieties are in the collection.

CEYLON.

Ceylon has an excellent and most interesting collection of paddy and rice from various districts sent by the Government and by the Ceylon Agricultural Association. There has been also sent, by the same Association, a collection of the small cereals and pulses. Ceylon, however, has no rice to spare, as it grows only half its consumption, and the small grains have no general or commercial interest, as they are of very low value for food. The grain products of Ceylon are therefore not dealt with in this report.

CYPRUS.

Cyprus, it has been thought, may again become a grain-producing country of importance, and has sent both wheat and barley to the Exhibition. The rich plain of the Messaoria, fertilized entirely by the deposits left by the winter torrents, which consist of the droppings of sheep and of leaves washed down from the mountains, bears good crops. The finest wheats and barley known are those of Lefca. Two sorts of wheat are exhibited: that named red is a harsh, long-berried, very hard wheat; that named white is a short-berried wheat, with an occasional mellow white corn. These wheats would not be acceptable in Western Europe. But it seems to be difficult to change the sort. Wheats from Enos were tried, and gave a large yield in grass, but not in grain. Acclimatized wheats are necessary. Everything depends on the rainfall. A fall of 16 inches means a beautiful crop; a fall of 6 inches will not give enough for seed. Irrigation is not used for grain, but it is for cotton. Water may be obtained, but what is wanted is outside help in knowledge and capital. The taxation is against any influx of immigrants. Wheat cannot be grown in Cyprus to sell at 30*s.* per quarter, and in consequence of the low current price, land has decreased in value. Cyprus can scarcely be looked to as likely to afford supplies of grain.

It now remains to state the conclusions to be drawn from the survey that has been made of the grain productions of the Colonies. It is obvious that the prosperity of some of our largest Colonies, especially Canada, Victoria, and South Australia, largely depend on the occupation and remunerative cultivation of the enormous tracts of land which they possess, and their speedy settlement depends on the attractions offered for the investment of capital and the employment of labour in agriculture. In the agricultural industry, wheat is the pioneer crop, the crop on which settlers depend for converting the stored-up riches of the soil into money. The results to be obtained from wheat-growing are the key of the future agricultural position of these Colonies. Western Europe is the market for the surplus production of the world, and wheat in Western Europe is at present at a very low price—the lowest known for a century and a quarter. Wheat cannot be grown at a profit at present prices, even in England, which has a higher yield per acre than any other country. To succeed, the Colonies must be able to grow wheat at a price lower than those ruling in Europe to the extent of the cost of carriage, freight, and incidental charges. If not, settlers cannot be expected to embark in a business which, on the face of it, is not remunerative. The question therefore to be determined is, whether wheat can be produced profitably at a cost so low as to be sold in England at present prices, which resolves it into the questions of what is the cost to the colonist of cultivating and gathering the crop, and to the merchant of conveying it to our market.

An attempt is here made to answer the question; but absolute accuracy is not claimed for the figures here given, nor do the limits of this report admit the discussion in detail of the items of cost. But every care has been taken in verifying the estimates which are given as the average result of an extended series of inquiries; much better and much worse results are obtained in individual instances. It is singular that the cost per acre under conditions so different as those obtaining in North-West Canada and Australia should be so nearly alike, but it may be broadly said that wheat can be grown within both regions at a cost within the limits of 25*s.* to 30*s.* per acre, disregarding the price of land, which is very small. It has been reported that at the famous Bell Farm, in the North-West, 20*s.* per acre will cover all the outgoings, but this estimate appears to be very low; while in South Australia, wheat can be grown at 25*s.* per acre. The cost of wheat per bushel depends on the cost of cultivation and on the yield per acre. Taking 30*s.* per acre as the cost in North-West Canada, and dividing it by twenty bushels, which is the average yield, the cost of the wheat is 1*s.* 6*d.* per bushel, or 12*s.* per quarter. In South Australia, 25*s.* being the cost, and the yield eight bushels, the cost is 3*s.* 1½*d.* per bushel, or 25*s.* per quarter; in Victoria, the cost is probably 27*s.* 6*d.* per acre, and the yield is twelve bushels, giving a cost of about 2*s.* 3*d.* per bushel, or 18*s.* per quarter. One of the great competitors in providing the supply of Europe now is India, and although it is impossible to determine the cost of growing wheat in that country, the best authorities agree that 16*s.* per quarter is a price at which it can be produced, and for the sake of comparison, the calculation of the cost of Indian wheat has been inserted. Adding to these initial figures of cost the charges for conveyance to England (which, it must be observed, are subject to frequent variations), insurance, brokerages, dealers' profits and cost of handling, the following results are obtained :—

	Canada, North West.	South Australia.	Victoria.	India.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Cost	12 0	25 0	18 0	16 0
Elevator, railway, and other charges to the port of shipment	11 6	5 0	5 0	6 6
Shipping charges, freight, &c., to England	4 6	7 0	7 0	7 0
English charges, brokers' and merchants' commissions	2 0	2 0	2 0	2 0
	30 0	39 0	32 0	31 6
Value at present (October, 1886) in England about	33 0	35 0	35 0	31 0 per 480 lbs.

In all these cases (except India), it must be observed that no allowance has been made for any payment for land, nor for interest of capital, either as working capital or for money absorbed in the original clearing or preparation of the land, fencing, buildings, making roads, &c., nor for any profit to the farmer beyond mere labourer's wages, if he should do labourer's work. On the basis of the above figures, which must be taken to be approximative only, and subject to variation, especially in the item of ocean freights, there would be a margin of about 7*s.* 6*d.* per acre in North-West Canada, and of 4*s.* 6*d.* per acre in Victoria, to meet these charges and to provide the settlers' profit, and in South Australia there would be a loss of 4*s.* per acre besides the out-of-pocket charges. While in the North-West of Canada a farmer may be able to pay his way, he could not do so in Victoria, as taking the fallow land into consideration, his land payments alone would nearly absorb the margin. It may thus be broadly stated that at prices for wheat such as have been current lately, and for a considerable period, there is no inducement to invest capital in, or to devote the labour to, its production in our Colonies.

In order to afford the means of comparison between the cost of producing wheat in England and on the virgin soils of the Colonies, an estimate is appended of the cost of growing an acre of wheat in this country. The figures are averages derived from detailed accounts, furnished by farmers and land agents, in a variety of districts. If these be correct, they prove the impossibility of wheat-growing in England without loss on the average to the grower, if he should have to sell his produce at the prices now and lately current.

Cost of the cultural operations, from ploughing to delivery to market	£3 10 0
Cost of manure, either by direct outlay or indirectly	2 0 0
Cost of seed	0 8 0
Rates and tithes	0 9 0
Rent	1 0 0
	£7 7 0
Deduct value of straw, say	1 0 0
	£6 7 0

Taking the average crop to be 30 bushels, the cost per bushel is nearly 4*s.* 3*d.*, or 34*s.* per quarter.

October, 1886.

A.—GRAIN IMPORTS TO THE UNITED KINGDOM.

Annual Totals.

Countries.	Wheat.—Total of Grain and Flour in equivalent Weight of Grain (1 cwt. of wheat flour = 1¼ cwt. of wheat in grain).														Countries.
	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	
Russia	15,689,943	17,938,977	9,693,997	5,798,976	10,157,847	8,911,788	11,003,917	9,150,151	8,117,485	2,963,759	4,099,972	9,679,941	13,448,368	5,520,450	12,082,391	Russia.
Europe (except countries specified)	4,772,045	11,036,334	8,523,077	6,034,669	11,276,440	6,322,395	12,608,766	8,262,929	5,799,512	3,595,773	3,725,461	6,427,164	6,114,674	3,765,945	4,194,510	Europe (except countries specified).
Austria	836,243	456,966	311,240	285,208	420,192	561,588	1,335,921	1,656,888	1,911,110	1,416,391	1,382,183	1,974,816	2,201,189	1,954,701	2,358,423	Austria.
Turkey, &c.	2,330,593	3,190,984	1,692,616	921,205	3,424,572	3,510,509	3,720,134	477,896	2,234,072	1,736,485	1,327,508	1,032,741	3,444,251	1,841,283	1,831,727	Turkey, &c.
United States (Atlantic Ports)	13,138,880	8,188,725	14,638,890	21,085,372	17,206,410	15,105,922	13,973,413	28,668,221	37,015,145	37,690,287	33,168,149	28,195,362	26,397,848	24,930,225	22,881,400	United States (Atlantic Ports).
United States (Pacific Ports)	2,486,451	1,445,624	7,136,220	6,120,680	9,165,741	7,117,481	9,620,592	4,919,939	7,604,474	7,092,813	12,531,807	16,692,819	13,818,987	10,631,427	16,056,331	United States (Pacific Ports).
Other Countries	735,542	2,480,021	2,486,594	2,547,379	1,225,733	1,459,000	1,406,331	134,272	1,782,431	1,577,402	1,255,854	1,893,887	2,657,397	1,562,502	2,170,912	Other Countries.
India	220,028	161,915	741,350	1,074,390	1,334,374	3,296,575	6,106,079	1,820,881	889,531	3,230,144	7,338,751	8,463,716	11,248,988	7,980,981	12,175,260	India.
B.N. America	3,782,776	2,157,170	4,315,709	4,298,315	4,069,565	2,776,975	3,265,174	2,939,400	5,353,697	4,543,407	3,200,434	3,115,769	2,428,417	2,618,401	2,595,376	B.N.America.
Australasia	369,726	556,180	2,091,504	1,156,599	1,263,747	2,842,200	451,102	1,561,006	2,294,653	4,613,353	3,314,540	3,086,288	2,790,152	5,369,358	5,443,588	Australasia.
Total	44,362,227	47,612,896	51,631,197	49,322,693	59,546,621	51,904,443	63,491,429	59,691,583	73,002,110	68,459,814	71,344,659	80,562,503	84,550,271	66,175,282	81,289,918	Total.

B.—GRAIN IMPORTS INTO THE UNITED KINGDOM.

Annual Percentages.

Countries.	Percentages of the Supply of Wheat and Flour derived from each country or group of countries.														Countries.
	18[illegible]1.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	
Russia . .	35·37	37·67	18·78	11·75	17·06	17·15	17·39	15·33	11·12	4·32	5·75	12·02	15·50	8·34	14·86	Russia.
Europe (except countries specified) .	10·78	23·18	16·50	12·24	18·94	12·18	19·86	13·84	7·95	5·25	5·22	7·98	7·23	5·68	5·16	Europe (except countries specified).
Austria . .	1·89	·96	·61	·58	·;1	1·09	2·09	2·85	2·62	2·07	1·94	2·45	2·60	2·95	2·90	Austria.
Turkey, &c..	5·25	6·70	3·.8	1·85	5·75	6·76	5·85	·80	3·06	2·54	1·86	1·28	4·08	2·78	2·25	Turkey, &c.
United States (Atlantic Ports) .	29·61	17·20	28·35	42·75	28·89	29·10	22·00	48·02	50·69	55·06	46·48	35·00	31·22	37·68	28·16	United States (Atlantic Ports).
United States (Pacific Ports) .	5·60	3·04	13·82	12·42	15·39	13·72	15·15	8·24	10·42	10·36	17·57	20·72	16·35	16·07	19·75	United States (Pacific Ports).
Other Countries .	1·65	5·21	4·82	5·16	2·06	2·81	2·21	·23	2·44	2·31	1·76	2·35	3·14	2·36	2·67	Other Countries.
India . . .	·50	·34	1·43	2·18	2·24	6·36	9·61	3·05	1·22	4·72	10·28	10·49	13·30	12·06	14·98	India.
B.N. America	8·52	4·54	8·36	8·72	6·83	5·35	5·14	5·03	7·33	6·63	4·49	3·87	2·88	3·96	2·58	B.N. America.
Australasia .	·83	1·16	4·05	2·14	2·13	5·48	·70	2·61	3·15	6·74	4·65	3·84	3·30	8·12	6·69	Australasia.
Total .	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	Total.

FRUITS.

By D. MORRIS, M.A., F.L.S.

AMONGST the objects of productive industry displayed at the Colonial and Indian Exhibition, there are few that have awakened so much interest as the array of fruits brought together in a fresh and preserved state from all parts of Her Majesty's Dominions. Fresh tropical and sub-tropical fruits were exhibited and regularly sold during the course of the Exhibition in the Colonial Market, and hundreds of thousands of stay-at-home English people realised for the first time what boundless stores of delicious fruits were capable of being supplied by our Colonies.

The limits prescribed for this Report entirely prevent anything like a detailed account of the exhibits. Wherever practicable, a brief statement of the general capabilities of each Colony in the way of fruits is given, and the more promising fruits for commercial export purposes are noted. More than this could not be attempted.

CANADA.

The best fruit produced in Canada is no doubt the apple. The magnificent trophy in the Canadian Court, wherein not only apples, but numerous other fruits, of the several provinces were shown, was a striking proof of the vast capabilities of the Dominion. The Canadian summer is a short but marvellous developing period, which is succeeded by a long and severe winter. In spite of this, however, the Canadian fruit-growers have made wonderful progress in the number and character of their productions, and have developed fruit-growing on a scientific basis with the best results. In the trophy above mentioned, fruits of all kinds grown in Canada and preserved in fluid were shown from the Provinces of Ontario, Quebec, and Prince Edward Island. These fruits were collected and arranged by Mr. William Saunders, to whom great credit is due for the complete and representative character of the exhibits. Among these fruits were apples, pears, plums, cranberries, quinces, the quaint but useless Osage orange, gooseberries, grapes, strawberries, currants, thorn-apples, raspberries, barberries, egg-fruit, crab-apples, blue-berries, native grapes, buffalo-berries (*Shepherdia argentea*). Apples were arranged altogether in eighty named varieties. Late keeping apples were shown at the beginning of the Exhibition, and up to the month of June, while early varieties of the season of 1886 were shipped from Canada, and on view at the end of August. Besides these, there were shown plums, peaches, and pears of exceptional quality.

During the month of October an Exhibition of Canadian apples was

held in the Conservatory of the Royal Horticultural Society, which attracted considerable attention. The Canadian apple best known in England is the Newtown Pippin, which as a dessert fruit is in season from January to March. The tree of this variety is invariably grafted, and is an uncertain producer. Hence its cultivation is not largely extended, and indeed is restricted to a few localities. The Canadians themselves do not appear to prize the Newtown Pippin as highly as Europeans do; the latter either from fancy, or from its attractive character in late winter, have placed its fruit first in the market. Of early apples, there are the Gravenstein, Alexander, Duchess of Oldenburg and St. Lawrence, in season from September to December; while of late apples there are Golden Russet, Gloria Mundi, Nonpareil, and many others, which are in season as late as May or June. The Gloria Mundi, in exceptional specimens, has been known to reach 18 ounces in weight. During the course of the Exhibition various plans were adopted to pack and ship Canadian fruits, and some of the experiments were of an interesting and suggestive character. The experiments made with a packing of infusorial earth between the double boarding of cases were found not to yield such satisfactory results as were at first anticipated. In fact, nothing was on the whole so satisfactory as a careful wrapping of fruit in tissue paper, to prevent bruising, and giving them as much air as possible in a cool storage. Soft fruit, such as plums, peaches and grapes, when packed in compartments, arrived in fair order; but during such an abundant fruit harvest as the last in England, foreign fruit of this character could not pay expenses. Now that the merits of late keeping Canadian apples are better known, there is no doubt that the demand for them will steadily increase. At present, owing to the round-about way of reaching the consumer, a barrel (three bushels) of apples, which in Canada is worth about 5*s.* or 6*s.*, is sold in England at something like 26*s.* or 28*s.* per barrel. Hence the greater part of the profit at present goes to the middle men.

As indicating the enormous proportions which the Canadian apple-trade has assumed, it is stated that the Province of Ontario alone has exported this year half a million barrels. All these do not come to England, a considerable quantity going direct to Norway and Denmark. British Columbia, as might be expected, is destined to become the competitor of California in choice fruits, especially in pears, which are magnificent both in size and quality.

In preserved, canned, and evaporated fruits, a large display was made by the Aylmer Canning Company of Ontario, and of those examined the pears, blackberries, peaches, cherries, plums, and apricots were excellent.

NEW SOUTH WALES.

As the apple is the fruit of Canada, the pine-apple the fruit of the Bahamas, and the banana the fruit of Jamaica, so the orange is destined, I believe, to be the commercial fruit of New South Wales. The samples of Sydney oranges shown in the Colonial Market, although evidently not

selected and graded according to the experienced style characteristic of Mediterranean oranges, sufficiently indicated the inherent good quality of the fruit. New South Wales oranges are expected to arrive in England in June, July and August, a time when no oranges can be produced in northern countries. This will naturally cause a change in the characteristics of the English fruit trade; but there is a manifest opening for good Colonial fruit during the early summer months, and Australian (and for the matter of that, Cape of Good Hope, and Natal) fruit-growers would do well to follow up their experimental shipments of the present year, and establish a market for their produce. So far, reference has been chiefly made to oranges from New South Wales. It is not to be supposed, however, that this is the only fruit that can be grown there. Excellent lemons, quinces, guavas, apples, apricots, peaches, nectarines, plums, figs, loquats and melons are also produced, and these in a preserved state formed a special feature in the New South Wales Court.

VICTORIA.

This, the richest and most prosperous of England's Colonies in the southern hemisphere, possesses wealth in her vegetable productions no less than in her mines and gold-fields. While importing a large quantity of fresh fruit, and what is called "fruit-pulp" from Tasmania, which latter is the orchard of Australasia, Victoria is able to produce, at certain seasons, large quantities of fruit, some of which, shown in London, has been of excellent quality. The canned or tinned fruits of Victoria indicated a near approach to the best fruits of California, which hitherto have monopolized European markets. In a special Report on fruits exhibited by the Red Cross Preserving Company, it is stated that "the quality is equal to many of the Californian fruits in the trade, and as soon as the prejudice is dispersed, arising from the introduction of Australian packs in English markets (it being quite a recent step), there will doubtless be a large trade done between the mother country and the dependency of Victoria."

The apple is the most esteemed of Victorian fruits, and thrives in all parts of the Colony. The apricot prefers the warmer districts, where its produce is both large and fine. Cherries are largely grown, and appear to thrive in the strong volcanic loams that exist in various parts of the Colony.

The fig grows exceptionally well in the warm northern districts, and fig-drying is being taken up as a local industry. The grape, both for wine-making and for a dessert fruit, flourishes in all but the coldest climates. In suitable localities the bunches and berries are described as of enormous size, fine colour, and excellent flavour. Melons are in great demand in local markets, and "a cross-bred variety of sugar melon" is much used for jam. The peach, often grafted on almond stocks, is one of the most delicious fruits grown in the Colony. The persimmon (Kaki) is becoming popular on account of its rich flavour and fine colour. Plums are abun-

dant, and are obtained in the markets at a low rate. The raspberry, grown in the rich valleys of the Yarra, is sent to Melbourne to the value of £150,000 annually; while of the strawberry, two, and even three, crops are not unusually borne in the year.

SOUTH AUSTRALIA.

This Colony, next to New South Wales, made a very successful show of fresh fruits. Its grapes, apples, and pears were of special interest, not so much for what they were in themselves, as for the possibilities which they foreshadowed, and the promise which they held out of an extensive and prosperous fruit trade between the Australian Colonies and the mother country. The resources of civilization in this instance are evidently being directed to a comparatively unworked field; and there is no reason why this trade in fruit should not grow into permanent benefit alike to producer and consumer. The special points wherein some shipments failed have already been pointed out by Mr. D. Tallerman, who had charge of the Colonial Market, and it is unnecessary to repeat them here. The knowledge, so far gained, will be of great benefit in arranging for future consignments. In packing fruit, it is suggested that "the cases for fruits should be of the ordinary flat shape, with one or two partitions. I find," says Mr. Tallerman, "that the fruit from Adelaide, in the old-fashioned cheap Tasmanian cases, with the apples papered, has arrived in good condition. Some South Australian shippers simply line the cases with paper, and pack their apples loose, and they have arrived equally well; but I recommend that all large and choice fruits be papered."

The dessert raisins, Zante currants, and Sultana raisins, shown in the South Australian Court, were of a most interesting character, and compared very favourably with the best qualities usually imported into England. It is evident that South Australia, no less than the Cape of Good Hope, can supply both the European and American markets to a large extent with these dried fruits, and they have done well to display in so enterprising a manner their special capabilities.

QUEENSLAND.

At least one-half of the vast territory of Queensland lies within the tropics; hence, in a classification of its fruits, they may very conveniently be divided into tropical and sub-tropical. Belonging to the latter class, there are the fruits of the orange family, Chinese and Japanese fruits, and the more delicate of English-grown fruits, such as apricot, almond and peach. Of tropical fruits grown in, or suitable for, the climate of Northern

Queensland, there are the banana, pine-apple, and mango, for which there is a very large local and Colonial demand, and it is said that "growers have for years past been accumulating wealth by growing and marketing them." An export fruit-trade exists between Queensland and Sydney, and having regard to the vast extent of rich lands suitable for fruit culture, there is scope for almost unlimited development.

Queensland scarcely did herself justice at the Colonial and Indian Exhibition in the matter of fruits; and indeed, judging by the specimens shown under Class 67 (fruits, fresh and preserved), it would be impossible to express an opinion respecting them. It is evident that it is not sufficient to grow good and choice fruits; but for external trade, the most approved and skilful methods must be studied for selecting, packing and shipping such fruits expressly for long voyages.

WESTERN AUSTRALIA.

The representation of fruits in the Western Australian Court comprised one magnificent pear weighing 3 lbs. and 3 ozs., some dried apricots and figs, dried peaches, several boxes of raisins, and a selection of preserves of Cape gooseberry, melons and gooseberry, and melon and limes.

There were exhibits of candied fruits, and one lot of preserved olives.

Judging by the specimens here shown, it is evident that both raisins and currants can be grown in Western Australia, equal to any in the English market. The stalk, or dessert raisins, prepared by C. W. Ferguson and C. C. Fauntleroy, were in excellent condition, and deserve special mention. Practically an undeveloped country, Western Australia cannot be expected to show advance in cultural operations equal to her sister-colonies. What she has done already, is good earnest of what she is capable of doing; and it is evident that choice and delicious fruits are to be numbered amongst the stores of her prosperous future.

NEW ZEALAND.

The best and most successful fruits for export purposes in New Zealand appear to be the apple, pear and quince. Excellent apples of a most attractive colour and size were shown in the New Zealand Court for three weeks after arrival, proving that they possess excellent keeping qualities.

Besides apples, there were received from New Zealand, during the course of the Exhibition, such fruits as pears, lemons, limes, walnuts, all of which arrived in fairly good condition. As the success of sending fruit such a long distance, assuming it was first carefully selected and graded, depended on the mode of packing, it may be useful to place on record the method

which appears to have given the best results. In a Report kindly placed at my disposal by the Executive Commissioner, Sir Julius von Haast, K.C.M.G., it is stated that of New Zealand fresh fruit:—

"In all, about thirty consignments were received. The first that came to hand, was in a case brought by Mr. John Bowman of Green Lanes, Auckland, in the *Sutlej*, *viâ* the Suez Canal: his mode of packing seems to have resulted satisfactorily. Mr. Bowman's apples were packed in a close case of Kauri pine, with no holes for ventilation. Each apple was wrapped in tissue paper, and completely surrounded with chaff, so tightly packed that the fruit could not shake about. The apples were from one-and-a-half to two inches apart at the nearest point. Each layer of apples was separated by a wooden shelf. The chaff was not dried artificially before packing. On opening the case, from 10 to 13 per cent. only were found unfit for use, the rest of them being in perfect condition, and still retaining their bloom. The apples had not sweated at all, nor had the dampness from the bad fruit affected the good ones near them. The fruit being large and fine attracted great attention from visitors, and when placed in a glass case in a prominent part of the Court, was generally taken for models similar to those shown by the Australian Colonies.

"Although packed in the Colony three weeks before subsequent arrivals, some of these apples were still good in the case after three weeks' exposure here. Mr. Bowman's apples are stated to have been packed in the last week in March, or more than three weeks before those of other exhibitors. A small barrel had been packed nearly twelve weeks when it was opened, and from the apples being wrapped in tissue paper and closely packed in chaff, only 14 per cent. of the contents were damaged."

After describing in detail the condition of fruit received, variously packed in twenty-nine other consignments, but not in such good order as the above, the Report concludes with the following remarks:—

"Judging from the result of this experimental venture, and from the high prices fine specimens of apples realised, viz. *6d.* to *1s.* each, there appears to be a good prospect of a paying business resulting from shipments made to arrive during the few months before European fruit comes to maturity.

"Fancy prices cannot of course be expected, as at a great International Exhibition, where novelty and curiosity lead to purchase, but remunerative returns from shipments arriving in good condition may be depended on."

Of fruits preserved in syrup, the only successful exhibit was that shown by Mrs. H. D. Knight, of New Plymouth, which consisted of an assortment of thirty-six New Zealand fruits in excellent order.

Of jams, the best exhibits were those of Messrs. Holland Brothers, Wellington, and Messrs. Kirkpatrick & Co., Nelson. All these were put up in attractive well-made tins, and consisted of strawberry, cherry, plum, black-currant, peach, raspberry, gooseberry, nectarine, tomato, green-gage, apple, Orlean plum, apricot and damson.

FIJI.

This Colony consists of a group of islands, variously stated at from 200 to 300 in number, situated in the Pacific Ocean, between Lat. 15° and 22° S. It is distant about 1900 miles from Sidney in New South Wales, and 1200 miles from Auckland in New Zealand. As giving an idea of the extent of this comparatively new British Colony it may be mentioned that "Viti Levu, one only of the eighty inhabited islands, is about as large as Jamaica, and considerably larger than Cyprus; that a second (Vanua Levu) would contain Mauritius three times over, and Barbados ten times; and that the aggregate area of the whole is greater than all the British West India Islands including Trinidad."

The fruit trade of Fiji, as might naturally be expected, has been developed by its geographical position in relation to the Australasian Colonies. It was started in the year 1877, on the occasion of a monthly line of steamers being subsidized to run between Levuka, the capital of the group, and Sydney. The progress made since then is shown by the following summary:—

	£	s.	d.
Value of fruit exported in 1877	507	10	0
" " " 1885	23,994	17	6

The green fruit exported consists chiefly of pine-apples and bananas, but hopes are expressed that oranges, limes, citrons, lemons, guavas, and mangoes will soon be added to the list, and the trade considerably increased. At present fruit ranks third on the list of exports. The samples of fruits in the Fiji Court consist wholly of preserved fruits prepared by J. H. Marrinon and the Fiji Fruit Preserving Company. The latter were in neat attractive-looking tins, and both lots indicate the resources of the Colony in this particular branch of industry in a favourable manner. They also lead to the conclusion that Fiji is fully capable of becoming the tropical fruit garden of the Australasian Colonies.

CAPE OF GOOD HOPE.

The excitement incidental to diamond-fields and other speculative undertakings no doubt tends to the neglect of purely agricultural and horticultural pursuits, and hence it is not a matter of surprise that the capabilities of the Cape of Good Hope in the matter of fruit should be practically an unworked field of commercial enterprise. The export of dried fruits in some years (1865) has reached a value of £11,000, while in other years (1881) it has fallen so low as £761. It is possible that the recent action of the Legislature, in granting a rebate of duty on sugar used wholesale for the manufacture of jams and preserves, may encourage the establishment of factories. The chief fruits preserved are Cape gooseberry, orange, lime, guava, quince, melon, citron, peach, fig, apricot; and Cape of Good Hope preserves are claimed "to surpass any of the English

manufactured fruits." Raisins are made from the Haanepot grape, and a small thin-skinned raisin (currants) from what is known as the currant grape. Artificial drying is recommended for both. Fresh grapes have been successfully shipped to Europe, and as they arrive in the early summer when the price of grapes is highest, there is an undisputed market ready, which the viticulturists of the Cape should duly utilize.

Returning to raisins, it is stated that about 200,000 pounds are produced annually, and if sufficient demand arose fully 500,000 pounds "could easily be produced." The fine samples of raisins exhibited in the Cape of Good Hope Court were of excellent quality. But it would appear that not much has been done yet, as compared with the possibilities of the Colony, to supply European markets. Strenuous efforts are being made, and this Exhibition will doubtless enable the producer of Cape raisins to have a larger trial than he has yet received. There are two kinds of raisins produced—stalk raisins for dessert, which are in demand all the year round, except during the short English fruit season; and loose raisins, which are used chiefly during the three winter months when British house-wives are concerned with plum-puddings.

The Cape of Good Hope, in the production of fresh fruit, especially grapes; in the manufacture on a large scale of preserves, jams, and jellies; and in the preparation of raisins and currants, has an extensive field for developing its fruit industries; and as it can place these in the European markets just at a time when they realise the highest prices, its future in this respect cannot be over-estimated.

NATAL.

This Colony contributed oranges in a fresh state to the Colonial Market which, although small, were of bright colour and fine flavour. The dried and preserved fruits in the Natal Court were throughout of a high class of excellence, and proved one of the most interesting in the Exhibition. Messrs. Jameson and Co., Durban, had a large assortment of preserves consisting of Granadilla (West Indian Sweet-cup) *Passiflora edulis*, loquat, quince, guava, peach, papaw, Cape gooseberry, pine-apple, green limes, and the native Amatungulu. Messrs. Baker and Cautherly, Estcourt, had an attractive exhibit of dried fruits, such as apple, pear, quince, yellow peach, and pine-apple. Mr. Thos. Proctor, Pietermaritzburg, illustrated the fruits of Natal by a collection consisting of seventeen large jars of whole fruits in syrup, which deserved special notice. Among these the most striking and interesting were the Amatungulu or Natal plum (*Carissa grandiflora*), of the natural order Apocynaceæ, which ripens with a white milky juice and has a pleasant refreshing flavour; and the Cape gooseberry (*Physalis pubescens*), of the natural order Solanaceæ. It is somewhat remarkable that both these wholesome and refreshing fruits belong to natural orders which usually produce fruits of a more or less poisonous character. The yellow peach of Natal, or St. Helena peach, as it is

sometimes called, is a cling-stone peach, which is so abundant in the Colony that it is often used for feeding pigs; and the ground under the trees of deserted Dutch orchards is almost paved with the stones of the fallen fruit. Sun-dried peaches and apples were exhibited by Mr. William Judson, Ladysmith, which might be supplied to the English market in large quantities and at cheap rates.

It is evident from the above brief review of the capabilities of Natal as regards tropical and sub-tropical fruits, that after supplying all local demands, as well as those of the neighbouring Cape Colony, it should be able to supply European markets in large quantities. In some of the preserves there was evidence of the sugar used being of too low a quality, giving a slight molasses flavour; while again the syrup in which whole fruits were preserved was too thick, and of a cloying sweetness. If these defects were removed there is no doubt that Natal preserves would possess special advantages, and their general use in European countries would be assured.

CEYLON.

Among the Ceylon Exhibits no fresh fruits were shown, neither were there any specimens in spirits or solutions, to illustrate the productions of the island in this particular section. Owing probably to the general dampness of the climate, the best fruits of Ceylon are certainly wanting in flavour as compared with the choice fruits of the West Indies; but having said this much it is to be noted that Ceylon is by no means so deficient as India of fruits either in quality or quantity. If the cocoa-nut were used and regarded simply as a fruit, Ceylon would rank as the largest fruit-growing Colony in the Empire. The luscious mangosteen has been successfully grown in special localities for some years; the durian is also grown but very sparingly; pine-apples attain large size and do well, though they are somewhat insipid as compared with the pine-apples of the Bahamas, Pernambuco, and Jamaica. Oranges are fairly plentiful and easily grown, although, on account either of the special variety established in the island or of circumstances of climate, probably the former, they remain green even when ripe, and are wanting in the rich colour, juice, and aroma of the fruits as generally seen in England. Limes and citrons are cultivated to a small extent. The Pumelow or Shaddock is a choice fruit in the best varieties, and is capable, inasmuch as it requires damp moist heat, of being grown more largely in Ceylon than any other of the Citron fruits. Excellent preserve is capable of being made from the Pumelow, which in the West Indies is highly esteemed. It also makes "candied peel" scarcely inferior to citron.

Mangoes are plentiful, and are generally of the Bombay sorts. The Rambutan (*Nephelium lappaceum*) allied to the Litchi is a refreshing fruit, which, if produced in large quantities, might be dried and exported. The Mora (*N. Longanum*) is sometimes produced in large quantities, but is seldom seen on the tables of Europeans. What are known as Bananas in

the West Indies are called in Ceylon Plantains. They are evidently identical, and are used in exactly the same manner, viz., as a dessert fruit. In the rich alluvial soil of the plains of Ceylon "plantains" might be grown on a large scale, but unfortunately there is no external market for the fruit, and only enough is grown to meet local demands or supply mail steamers at Colombo.

Having thus indicated very briefly the general character of the fruits of Ceylon as known in the island, it only remains to refer to the preserves, fruits and pickles shown in the Ceylon Court, which were exhibited by the Government. These consisted of pickles made of lemon, papaw, cocoa-nut, cabbage and nutmeg, and of preserves made from mango, areca-nut, Lovi-lovi (*Flacourtia inermis*), Kamaranga (*Averrhoa carambola*), and nutmeg. In the excellent Official Handbook and Catalogue of the Ceylon Court, there is given, what is wanting in every other Court in the Exhibition, exact particulars as regards the origin and mode of preparation of the exhibits. As likely to be of general interest to persons residing in the tropics, the following description under preserves and pickles is given in full:—

Grape Jam is made from Jaffna-grown grapes boiled in syrup, the seeds being removed during the boiling; two pounds of grapes to one pound of sugar in a pint of pure water is the proportion in which it is prepared. The jam keeps a long time if preserved in air-tight bottles. The average price of a pound of grapes is thirty cents.

Mango Jam is prepared by boiling the mango in syrup after removing the skins and stones, and the sour juice squeezed out by the use of forks, and soaking in fresh water; two pounds of mango to one pound of sugar is the proportion in which it is prepared. The average price of a pound of mango is three cents.

Bilimbi Jam.—This jam is made by removing nearly three-fourths of the juice of the fruits of *Averrhoa Bilimbi*, by the use of forks, and soaking in fresh water, squeezing the fruit, and boiling them in syrup. The cost of 100 fruits is about three cents, and the proportion of sugar used is similar to that used with mangoes.

Nelli Jam.—This jam is prepared by soaking the fruit of *Phyllanthus Emblica* in pure water, and boiling the juice in syrup; the proportion of sugar and fruit is the same as that with mangoes. The cost of 100 fruits is about six cents.

Citron and Lime Pickles.—Citrons and limes in both the Northern and Western Provinces are first cut into four parts, with one end kept to hold them together, and salt inserted, and dried for some time. The Brahmins use curry stuffs and the sediment of the lime-juice for preserving it, whilst others use vinegar.

Mango Pickle.—Well-matured, but not ripe mangoes are cut lengthwise in halves, and the kernel of the seed is removed. The pieces being washed and salted for a day or two, the space occupied by the kernel is filled up with a preparation of well-chopped papaw fruit, garlic, onion, chilli mixed with ground mustard and vinegar, and the two halves are brought together, and tied up and put into a large-mouthed bottle or jar filled with vinegar; after remaining so for a week the pickle is fit for use.

MAURITIUS.

With the exception of one or two samples of preserves, Mauritius made no display of its fruits, although it is well known that the island in Lat. 19° S. produces most tropical fruits, such as pine-apples, bananas, litchis, and guavas, in considerable quantities. The natural outlet for fresh fruit from the Mauritius, especially in the winter months, is evidently the Cape, and possibly South Australia, and with suitable and regular shipping facilities, a business in fruit should assume some importance. The island produces first-class sugars suitable for preserving and canning fruits, and the depression in sugar should lead to attention being directed to the cultivation of fruit and to its export in quantities to any market offering remunerative results. Oranges appear to be comparatively scarce, but pine-apples and bananas alone should prove of sufficient importance to be placed among the exports of this fertile island.

The peach grows and bears good crops in most parts, and its fruit is an article in local commerce. The demand for the Alligator or Avocado pear is greater than the supply. Strange to say, the bread-fruit is not, according to Mr. Horne, so highly esteemed in Mauritius as the Indian jâk fruit. The strawberry grows well in the high lands, and the "Colonial" raspberry (*Rubus rosæfolius*) yields an abundance of fruit in a wild state. The Cythére (*Spondias dulcis*) is one of the choice fruits of Mauritius, and its cultivation deserves attention. Jams and jellies are made, for local consumption, from the cherry-tomato, which is evidently suited to the climate. The impression which a careful consideration of the circumstances of Mauritius, as regards fruit, leaves on the mind is, that its capabilities in this respect are not fully realised, and the people lose large sums of money which might do something to alleviate its present depressed condition.

STRAITS SETTLEMENTS.

In the notes on Perak it is stated that tropical fruits are supposed by the great majority of English people to be far finer, richer and better in every way than those grown in colder climates; but according to the writer of the notes, such is not really the case. Malayan fruits are admitted to exceed English fruits in size and often in strength of flavour and odour, but it is claimed that the English strawberry, pear or peach (or a green-house pine) is quite unequalled by anything grown in tropical countries. This after all is purely a matter of opinion; and the fact cited that Europeans in the tropics ignore local fruits and fall back on tinned and bottled English fruits, is merely another way of saying that Europeans have certain set habits and tastes, and a love of "home" things, which they will not or cannot give up. It must be remembered, however, that tropical fruits have not, as a rule, received that careful and scientific culture which has been expended on European fruits: in fact that they are practically wild fruits, more or less indigenous to the country, and suited to be used only under the special cir-

cumstances in which they are found. A pine-apple grown in a tropical country and costing only a few pence may not be equal in size and flavour to a pine-apple grown in an English hot-house, and costing twice as many shillings. But what English fruit is so refreshing and so suitable for the composition of a really well-cooked dish in the tropics as the lime?

Opinions may differ as regards the special merits of the mangosteen, "fig"-banana, mango, cherimoya, freshly-gathered date, the litchi, a really good orange, or a dozen other tropical fruits that may be named; but if we take each one on its merits, and use it according to the circumstances and habits of the country in which it is found, there are few, if any, English fruits that are so well adapted to refresh and revive flagging physical energies, as those we meet in the tropics.

Having said this much by way of defence of tropical fruits, I turn to the varied and interesting collections shown in the Court of the Straits Settlements.

The chief place is taken by the pine-apples of Singapore, which, preserved whole in syrup, have entered into commerce, and are now regularly supplied by London stores. The pine-apple is canned and shipped in a similar manner from the Bahamas, Fiji, and Natal; but owing probably to the greater enterprise shown by Singapore firms such as Bastiani, Tye Seng Bee, and Nethersole & Co., each of whom have London agents, the Singapore pine-apple has established itself as one of the best in the market. There were stalls with a tasting-bar maintained at the Exhibition, which no doubt greatly contributed to make the Singapore fruit widely known. The Singapore Preserving Company, the Chasserian Land Planting Company, C. Favre & Co., J. Graham, and others, exhibited an excellent series of tropical fruits, which attracted considerable attention. Many of these fruits, unfortunately, had only the native names both on samples and in the Catalogue, and hence were difficult to recognise. But the mangosteen, durian, mango, papaw, guava, pumelow, rambutan, banana, lemon and bread-fruit were easily recognised.

BRITISH GUIANA.

Owing to the enterprise of Messrs. Scruton & Sons in fitting up one of their steamers with a cool-chamber, fresh tropical fruits from British Guiana were among the most interesting features of the Colonial Market. It is now clearly demonstrated that by careful and judicious treatment and storage in a cool-chamber, numerous tropical fruits from the West Indies can be brought to England in a perfectly sound condition. Bananas arrived from British Guiana on several occasions which were sold for the first time in the London market, while such perishable fruits as papaw, sapodilla or naseberry, bread-fruit, mango, and the Avocado pear were received from the West Indies in excellent condition, and utilized as dessert fruit at English dinner tables. As an experiment the enterprise has been thoroughly successful. There remain, however, many details to be arranged before a regular trade in tropical fruits is established, but of ultimate success there would appear to be little doubt.

In the rich alluvial soils of British Guiana, all tropical fruits are capable of being cultivated: and the dried and preserved articles shown in the British Guiana Court, no less than the models of fruits produced in the Colony, would indicate that a large and undeveloped field of industry is connected with them.

JAMAICA.

The fruit industry at Jamaica is one of the most important of any tropical Colony. The value of fruit exported from this island, chiefly to the United States, is nearly £200,000 annually. The principal fruit so exported is the banana, which, in 1885, reached a total value of £129,917. Next comes the orange, of the value, in 1885, of £31,660. The development of the fruit trade in Jamaica has been very rapid, and, as in British Honduras, was chiefly due to the establishment of subsidized steamer communication, whereby regular and rapid sailings were secured and loss of fruit in transit reduced as much as possible. In 1867 the value of the fruit exported from Jamaica was only £728. Two years later an agency was established at Port Antonio (which was then a decaying port) for certain fruit houses in the United States, and seven schooners were loaded with bananas. In the following year cocoa-nuts and oranges were added, and since then the trade has gone on progressively, and has extended itself throughout the island. Several steamers are now engaged in this profitable business, the greater part of the fruit being conveyed to New York, Philadelphia, Baltimore and New Orleans.

The Jamaica fruit consisting chiefly, as noted above, of bananas and oranges, is packed in the hold of ordinary steamers, with no special appliances or cold storage. Every effort is made to give the fruit as much air as possible; but there is much room yet for improvement both in the selection and packing of the fruit, as well as in the arrangements for carefully stowing it on board ship.

Jamaica produces numerous choice and luscious fruits, which are, however, too delicate to bear a long sea-voyage, and hence are comparatively unknown in Northern latitudes. Amongst the samples of fruits preserved in spirit, and shown at the Jamaica Court of the Colonial and Indian Exhibition, there were Cherimoya (*Anona cherimoyer*), Sweet Sop (*Anona squamosa*), Alligator Pear (*Persea gratissima*), Ginep (*Melicocca bijuga*), Tamarind (*Tamarindus officinalis*), Jew Plum (*Spondias dulcis*), Mango (*Mangifera indica*), Papaw (*Carica papaya*), Guava (*Psidium guaiava*), Chinese Guava (*Psidium cattleyanum*), Blimbing (*Averrhoa bilimbi*), Coco Plum (*Chrysobalanus icaco*), Akee (*Blighia sapida*), Sweet Cup (*Passiflora edulis*), Pomegranate (*Punica granatum*), Naseberry or Sapodilla Plum (*Achras sapota*), Tree Tomato (*Cyphomandra betacea*).

This, although a fairly representative list of West Indian fruits well known and largely produced at various elevations in Jamaica, is by no means an exhaustive one. With cool storage and refrigerating chambers fitted up in rapid-going steamers, a large number of other fruits might be

utilized and exported. Of fruits not mentioned above, there are the Sour Sop (*Anona muricata*), Custard or Sugar-apple (*Anona reticulata*), Granadilla (*Passiflora quadrangularis*), Pomme d'Or or Water Lemon (*Passiflora laurifolia*), Calabash Sweet-cup (*Passiflora maliformis*), Caramba (*Averrhoa carambola*), Bread-fruit (*Artocarpus incisa*), Anchovy Pear (*Grias cauliflora*), Loquat (*Eriobotrya japonica*), Rose-apple (*Jambosa vulgaris*), Mammee Apple (*Mammea Americana*).

The particular variety of banana exported from Jamaica is the large yellow kind, sometimes known as the Martinique banana, but now generally known in the United States as the Jamaica banana, to distinguish it from the large red banana formerly exported from Cuba. The Cuba banana has now been almost entirely replaced by the brighter and more attractive as well as the more luscious fruit from Jamaica. The banana generally seen in England is the Chinese banana (*Musa Cavendishii*), which has a smaller fruit than the variety of *Musa sapientum* above described. The choice and small bananas known in the West Indies as Fig bananas are seldom exported: the attention of traders being evidently directed to the larger and more bulky, though less delicate varieties, which make a greater show in the market.

The oranges exported from Jamaica are a sweet well-flavoured kind, with a fairly thick rind and a bright colour when ripe. They approach very nearly to the once noted St. Michael's oranges, from which they were, no doubt, once derived. The trees yielding the bulk of the present oranges in Jamaica are self-sown seedlings growing in cattle pastures—although several well-kept plantations in the neighbourhood of railways and shipping ports are springing up.

Limes are abundantly produced, and while some (809 barrels) are exported in the green state, or pickled in brine (to suit the special taste of the people in the States), the larger quantity is utilized in the preparation of lime-juice, which is exported to be converted into citric acid to the extent of 55,000 gals. annually. Sicily lemons and the true citron are being cultivated on a small scale, while a choice pink-fleshed pumelow is also planted.

Pine-apples are exported in the green state only. The choicer sorts, like the Ripley pine, which have been known for the last hundred years as the most acceptable of Jamaica fruits, are seldom able to bear the rough treatment at present accorded them. The Madeira and Canary pines, which reach England in such excellent order, are packed in light boxes with a separate compartment for each fruit. The Jamaica fruit, on the other hand, is badly selected in the first place; and is generally packed in bulk two or three dozen together, in an ordinary flour barrel.

The mango is completely naturalized in the island, and thousands of tons of this fruit are produced, of which probably only one-fourth is at present utilized. The crop comes in from May to September, when, unfortunately, there is little demand for tropical fruits in the northern markets. The best varieties might be canned or preserved: and, in my Report on the Botanical Gardens of Jamaica for the year 1884, p. 45, I have there suggested that the commoner sorts might be utilized in the production of a useful spirit, or for the manufacture of glucose.

BAHAMAS.

These islands, from their proximity to the United States, and the rapid means of communication, were the first to establish an export trade in tropical fruit, which, in the one item of pine-apples is possibly the largest of any in the world. The particulars of fruit exported in 1885 are as follows :—

	Quantity.	Value.
Pine-apples	455,965 doz.	£50,847
Shaddocks	34,000 No.	64
Avocado Pears	2,950 ,,	8
Bananas	15,358 ,,	618
Cocoa-nuts	26,170 ,,	193
Oranges	1,900,000 ,,	1,753
Sapodillas	102,550 ,,	26
	Total value	53,509

The tinned pine-apples of the Bahamas, as also the bulk of the fresh fruit, form a large trade ; but, under a more careful and enterprising system of cultivation, it is possible to extend and improve this industry, which in many respects is the best suited of any to the circumstances of these islands. The pines generally cultivated are the Cuban and Scarlet varieties, which evidently thrive well in hot shallow soils. The Bahamas Factory exhibited a series of preserved fruits, as also pine-apples preserved whole in a similar manner to the Singapore fruit. The guava jelly from the Bahamas was excellent. Models of tropical fruits were well shown. The general character of Bahamas plants was illustrated by water-colour drawings made by Mrs. Blake, wife of the Governor, and among these were accurate and life-like delineations of many West Indian fruits.

BRITISH HONDURAS.

Since British Honduras was connected with New Orleans, the great commercial port of the Southern United States, by a regular mail service, the fruit industry has assumed some importance. The exports for the year 1884 consisted of: bananas, 88,538 bunches, of the value of £7869 ; cocoa-nuts, to the United Kingdom, 796,172, of the value of £2688, and to the United States, 757,977, of the value of £2833 ; limes, 6½ barrels, of the value of £3 ; mangoes, 47 barrels, of the value of £24 ; oranges, 12 barrels, of the value of £6 ; Avocad opears, 6 barrels, of the value of £4 ; pine-apples, 8496 barrels, of the value of £1017 ; and tamarinds, 6 barrels, of the value of £3. The total value of fruit exported in 1884 was £14,464. The cocoa-nuts of Central America and British Honduras are of large size, very heavy, and generally command the highest prices. The whole sea-board of British Honduras should in time be covered, as in Ceylon, by extensive groves of this valuable palm. Bananas are being extended in the

alluvial soils of the Southern districts, and find a ready market. Oranges, limes and lemons are hardly yet established, although in the drier and more rocky portions of the Colony they would do well. Pine-apples are grown in light loamy soils; and although the exports at present are small, they are gradually increasing.

There is in this Colony an unlimited field for fruit-growing; but it is right to mention that only those who have had previous experience in the tropics and possess some capital are suitable for pioneering work in a comparatively unopened country. British Honduras was too remote to exhibit fresh fruit at the Exhibition; the dry cocoa-nuts were, however, a conspicuous feature in the decorations. The preserved fruits consisted of preserved citron, preserved papaw and a wild fruit known as "Craboo," preserved in rum, very much resembling cherries. Tamarinds preserved in sugar were shown by two exhibitors.

TRINIDAD.

This island so far exports only cocoa-nuts under the category of fruits, but it is capable of growing and exporting immense quantities of all kinds of tropical fruits if a suitable market were available. In the Trinidad Court were numerous samples of preserved fruits of an attractive character.

GRENADA.

The fruits of Grenada were excellently shown in large glass jars by Colonel Duncan, to whose enterprise the island owes much in the introduction of new objects of culture. Amongst the fruits exhibited were granadilla, pine-apple, nutmeg, tamarind, shaddock, custard apple, *pois doux*, lime, sapodilla, mammee sopote, sour sop, mammee apple, papaw, bread-fruit, forbidden fruit, jack fruit. Preserved oranges, nutmeg jelly, guava jelly and shaddock peel were also shown. The exports of fruit from Grenada at present consist of cocoa-nuts of the value of £49, pine-apples, &c., £52, and plantains, £285.

TOBAGO.

This island made an excellent show of preserved fruits and jellies too numerous to mention. A canning establishment would appear to have a good field for starting operations here: and as land is cheap and labour

abundant, "capital and well-directed energy" are the only requisites to success. In quality and general representative character the preserved fruits of Tobago, consisting of above 200 exhibits, were the most complete of any in the tropical section.

ST. LUCIA.

The Agricultural Society of St. Lucia exhibited the fruits of this island in a preserved state, consisting of about twenty specimens, such as shaddock, orange, tamarind, pine-apple, lime, mango, papaw, pinguin, granadilla, tomato, guava. A small trade in fruit exists between St. Lucia and Barbados of the value of £400, but this fertile island is capable of great development in almost every department of tropical culture.

DOMINICA.

This island resembles Jamaica in its physical conformation as also in its productions. Limes are cultivated for the sake of the expressed juice: but oranges, bananas, cocoa-nuts, and indeed all choice tropical fruits are capable of being produced, and an industry in fruit, which at present is of the value of £3444, is gradually increasing.

ANTIGUA.

The pine-apples of Antigua in a fresh state were on sale at the Colonial Market throughout the Exhibition. They are smaller and not so delicate in flavour as the fruits which come to England from the Azores, but there is a large demand for pine-apples in the early summer months which Antigua is well able to supply.

MONTSERRAT.

This small island has become the head-quarters of the lime industry in the West Indies, and there were exported in 1884:—lime-juice of the value of £10,300, green limes of the value of £325, tamarinds of the value of £254, and general fruit of the value of £93.

BARBADOS.

As a large sugar-producing Colony, Barbados draws supplies in fruit from the neighbouring islands: but it exports preserved tamarinds to the value of £1305.

CYPRUS.

"This island is not only noted for its abundance of oranges and lemons, melons, apricots, cherries, almonds, and fine pomegranates, but also for grapes of exceptional good quality." Such being the case, it is a matter of regret that a larger collection of the characteristic fruits of the Eastern Mediterranean region was not shown. The exhibits consisted only of hazel-nuts, almonds, walnuts, caroubs, and two jars of raisins. The walnuts were large and bright looking; the raisins were of exceptional size and quality. Figs are most abundant in Cyprus, but it is said that they are inferior to those of Smyrna.

The chief trade in fresh fruit, after satisfying local demands, is with Egypt. Pomegranates appear to be the chief article of export, and these are in great demand at Port Said, 250 miles distant, and Alexandria, 300 miles distant. Although not a fruit in the general acceptance of the term, the Caroub, or Algaroba bean, the produce of a large tree, *Ceratonia siliqua*, is an important article of export from Cyprus. This bean contains much saccharine matter, and is very nutritious. Although sometimes eaten, its chief use is in the manufacture of food for cattle. A "black honey made from Caroubs" was not honey in the general acceptance of the term, but evidently a pulpy saccharine matter extracted from the Caroub beans.

TEA.*

By A. G. STANTON.

THE prominent position occupied by the Tea industry invests its gradual development with a special interest; the conspicuous part which the enterprise has played in our national prosperity enhances this interest still more; and the large number of our fellow-subjects to which it affords employment raises this interest into a very household word amongst us.

In the year 1800 no more than 20,358,827 pounds of tea were consumed in the United Kingdom; in 1835 the quantity had increased to 36,574,004; in 1864 to 88,500,000 pounds; and in 1885 to 182,408,830. The amount consumed per head of the population in 1800 was 1·25 pounds, in 1864 it had increased to 2·95 pounds, and in 1885 to 5·02 pounds. The British capital invested in the enterprise amounts to several millions; and it is within the mark to say that the welfare of many hundreds of thousands of Her Majesty's subjects depends upon the prosperity of the industry.

A quarter of a century ago our supply of tea was drawn almost exclusively from China and Japan. British-grown tea was then struggling into existence through the cultivation of the plant in India, and was just becoming known in the commercial world. The growing appreciation of Indian tea by the British public so steadily encouraged this new industry that the imports rose from 2,796,000 pounds in 1864 to 76,585,000 pounds in 1886. These increasing supplies, added to the heavy arrivals from China, induced a gradual cheapening of the article. Tea was thus brought within reach of the masses of the population, and its consumption greatly increased. Indian tea was found to possess qualities which imparted such strength and character to the weaker liquoring China teas that it was largely used for blending the two sorts. The public thus obtained an article which, simultaneously with a reduction in its price, was gradually improving in quality.

The successful cultivation of tea in India and its increasing consumption in Great Britain had already combined to draw the attention of our Colonies to the undertaking when the devastation of the coffee plantations of Ceylon by the *Hemileia vastatrix* induced her planters to encourage the growth of tea. The quality of Ceylon tea and its wonderfully rapid increase in production are speedily rendering it an important factor in the London market.

In Africa, Natal has become a pioneer of the industry by devoting several hundred acres to the cultivation of the plant. The newly-acquired Colony of Fiji has already tested the resources of her numerous islands by establishing plantations extending over some 300 acres, and in the Empire of Johore a small area has also been planted with tea.

* In this Report India has been included.

The Tea industry was represented in the Exhibition by 1374 specimens, mostly shown in glass vessels. The following table gives the number of samples from each country, with the number of gardens exhibiting. All the principal grades of black tea were represented, and, in addition to the ordinary teas of commerce there were some exceptionally handsome specimens of golden and silver Flowery Pekoes. Only twenty-one samples of green tea were exhibited, very little of this variety being now made in British dependencies.

	Samples.	Gardens.
India	684	150
Ceylon	624	167
Natal	37	6
Fiji	16	2
Johore	9	1
Jamaica	4	1
	1374	327

From the opening of the Exhibition on the 4th May until its close on the 10th November, 5,550,745 visitors were registered; hence the opportunities for inspecting the various specimens were very great.

Arrangements having been made for the sale of Indian and Ceylon tea both as a beverage and in packets, two separate committees were formed to superintend the purchase of suitable teas and to guarantee their purity. The management of the selling department was entrusted to Messrs. H. S. King and Co., the Agents to the Royal Commission, who worked in co-operation with these committees. A dépôt was opened for the sale of Natal tea in a similar manner on the 14th June.

By this means 47,239 pounds of tea were sold at the Exhibition in the dry state, in addition to about 730,980 cups as a beverage, in the preparation of which 12,183 pounds were used.

The following is an analysis of the sales :—

Quantity sold in packages, &c. lbs.		Quantity infused. lbs.	Approximate number of cups sold.
23,606	Indian tea	5,784	347,040
23,086	Ceylon tea	6,055	363,300
547	Natal tea	344	20,640
47,239		12,183	730,980

The total quantity of tea thus disposed of amounting to 59,422 pounds.

The Indian teas sold comprised representative teas from the principal districts.

Three Lectures were delivered in the Conference Room. One upon "British Grown Tea," and one upon "Ceylon Tea," both by Mr. J. L. Shand, the Commissioner of the Planters' Association of Ceylon; and one upon "Indian Tea," by Mr. James Peter, of Sylhet, India.

INDIA.

The official statistics for the year 1884 give the number of tea gardens in India as 3432, with a cultivated area of 267,710 acres, and a total production of 65,947,946 pounds. For the year 1886 the production had increased to about 75,000,000 pounds, the value of which in this country was nearly £4,000,000, in addition to a duty of £1,875,000. The capital embarked in the enterprise in India is estimated at £18,000,000, and the labour employed is considerable. In 1884 there were 278,036 imported labourers on the tea estates in the Province of Assam alone, where there were then 970 gardens with 189,852 acres under cultivation.

The cultivation of the tea plant is carried on in localities which are vastly different in physical and climatic conditions, in altitudes ranging from sea-level to about 7000 feet, in soils which are entirely dissimilar in their constituent parts, and in districts which are separated from each other by hundreds of miles. Hence the suitability of the plant to a great portion of India is beyond all question.

The tea-producing districts are situated chiefly in the Provinces of Assam and Bengal, a small quantity being also grown in the North-West Provinces and Madras. The most important districts are mentioned below; the number of samples representing them at the Exhibition is given, as well as the number of gardens by which these specimens were sent:—

Assam Proper	258 samples			58 gardens.	
Cachar and Sylhet	137 „	including 1 green		30 „	
Darjeeling and Terai	168 „			38 „	
Dooars	15 „			4 „	
Chota Nagpore	5 „			2 „	
Chittagong	4 „			1 „	
Kangra Valley	35 „	including 7 green		8 „	
Kumaon	16 „	„ 6 „		2 „	
Dehra Doon	9 „	„ 3 „		3 „	
Neilgherry	17 „	„ 4 „		3 „	
Andaman Island, Gov. Estate	2 „			1 „	
Unspecified	18 „				
	684 samples		21 green	150 gardens.	

Origin.—The tea plant appears to have been discovered growing wild in Assam as long ago as 1819 to 1821, and specimens were again found in 1823. However, no definite idea of cultivating tea in India appears to have been entertained until 1827. Even then no actual progress was made, and the value of the indigenous plant remained unrecognised. In 1834 Government commenced the enterprise by causing plants to be obtained from China, and attempts were made to open up tea plantations in Kumaon. The first tea garden in Assam was opened at Luckimpore in 1835; and in 1838 a small quantity of tea from this province was received into England. Large quantities of plants and seeds were again brought from China in 1848 and 1851,* and about 1854 plantations were opened up in various parts of Assam.

In the meanwhile, however, fresh attention had been directed to the

* It is interesting to note that some of the original Wardian cases in which Mr. Fortune brought these plants from China were still in existence a year or two since and could be seen at a few places in Assam.

indigenous plant in Assam, and after various experimental plantations of native tea had been opened, a garden belonging to the Assam Company was planted with it about 1840; thus, its capabilities becoming gradually recognised, steps were at last adopted to promote the more general cultivation of the indigenous plant.

Some years later—about 1863—speculation imparted a great impetus to the industry, and resulted in the opening up of large tracts of land in various localities. Although in many instances the results to individuals were disastrous, the industry had now become firmly established in the country, and has since continued to increase until its present dimensions have been attained.

The result of importing the China variety, and growing it in proximity to the indigenous plant, has been the Assam Hybrid, a shrub which, on account of its hardy nature, is now largely used in cultivation.

Progress in Great Britain.—Indian tea usually possesses great strength, and often a flavour which is peculiarly delicate. These qualities render it invaluable for imparting to the China variety the mellowness now so appreciated in a blend of the two sorts. The introduction of Indian tea into England was gradual, but the retailer, having once commenced to blend it, speedily increased the proportion used; in addition to this its use in a pure state has grown rapidly during recent years in many localities, and the public has shown an increasing appreciation of blends of the richest liquoring and most fragrant sorts of Indian tea, unmixed with the China variety. The consumption in 1864 was only 2,796,000 pounds, or 3 per cent. of all the tea used; in 1869 it had increased to 10 per cent., and in 1879 to 22 per cent. of the whole. This development of the industry greatly interfered with the consumption of China tea, which fell from its maximum of 126,552,000 pounds in 1879 to 104,226,000 pounds in 1886, the deliveries of Indian tea having increased during the same period from 34,092,000 to 68,420,000 pounds, and amounting in 1886 to 38 per cent. of all the tea used.*

No stronger proof can be adduced of the hold which Indian tea has obtained in Great Britain; its progress may have been slow, but it has been sure; no taint of adulteration has ever sullied the reputation of British-grown tea; its purity has been above suspicion, and its character unimpeachable. The substitution of machinery for the performance of many of those functions which in China are carried on by the hands of the natives, greatly reduces the probability of contamination, and tends to preserve the aromatic properties natural to the leaf.

Awards.—If additional proof be needed as to the regard in which Indian tea is held, it is afforded by the numerous awards received at various International Exhibitions.

In the Great Exhibition of 1851—three prize medals were awarded to it.

In the Paris Exhibition of 1855—Indian tea was honourably mentioned.

In the London Exhibition of 1862—four medals were awarded.

In the Paris Exhibition of 1867—gold medals were awarded to six districts.

In the Vienna Exhibition of 1873—several medals were awarded.

In the Philadelphia Exhibition of 1876—Indian tea was not represented.

* Further statistics will be found in the tables appended at the end of this Report, pp. 164 *et seq.*

In the Paris Exhibition of 1878—a gold medal was awarded, and in all twelve medals and several honourable mentions.

In the Melbourne Exhibition of 1880 and 1881—silver medals were awarded to six districts.

In the Amsterdam Exhibition of 1883—fifty-eight awards were obtained, viz., one diploma of honour, seven gold, seventeen silver, and fourteen bronze medals, and nineteen honourable mentions.

Almost every important district shared in these awards.

The varied character of tea produced in different localities necessitates separate allusion being made to each of the principal districts.

ASSAM.—The tea known in commerce as "Assam" is grown in that portion of the Province of Assam which lies in the valley of the Brahmapootra, and comprises the districts of Seebsaugor, Luckimpore, Durrung, Nowgong, Kamroop, and Goalpara. The changes wrought in this province by tea cultivation are truly marvellous, and have resulted in its transformation from vast forests of jungle into a nest of busy and flourishing plantations.

The chief feature in Assam tea is its great strength, which renders it of the utmost service for imparting body to weaker teas. Whether the cause of this peculiarity is to be found in the moisture and heat of the climate, the rich dark loam of the soil, or the indigenous nature of the plant, it is difficult to determine. The plant was here first discovered in its wild state, and here is the chief seat of the tea plantations, although the distance from the sea-port of Calcutta is great, and labour is also an expensive item.

Kamroop is the nearest of the Assam districts to Calcutta, which can be reached by railway from Kauni, near Dhubri, in forty-eight hours; the tea, however, is usually sent by the Brahmapootra river and through the Sunderbunds—a distance of 500 miles, which requires seven days for its accomplishment by steamer.

Luckimpore is the most remote district from Calcutta; its principal town of Dibrugarh on the Brahmapootra is distant 856 miles direct, and about 1000 miles round the Sunderbunds. It is the terminus of the river traffic; the journey by steamer takes fourteen days, but can be reduced to seven by using the Eastern Bengal Railway from Goalundo to Calcutta. Assam itself is entirely devoid of railways, with the exception of fifty miles running from Dibrugarh, and twenty-eight miles of light railway in Jorehaut. Tea gardens in these two localities thus possess facilities for communication with the river, which are enjoyed nowhere else in Assam, most of the gardens being compelled to bring their produce to the Brahmapootra, either by the tributary rivers or by road.

Railway communication would be an unquestionable boon to the planter.

CACHAR and SYLHET, although in the Province of Assam, lie in the valley of the Surma to the south of the Brahmapootra valley, from which they are separated by a range of hills. The character of the tea from these districts is somewhat similar to that from Northern Assam, although lacking its peculiar pungency; on this account, probably, it is more appreciated unmixed; indeed, in those localities where Indian tea is chiefly used in its unblended condition, teas from these districts are often much sought after. The soil resembles that of the Brahmapootra valley; the surface of the land,

though in many places level, is broken by irregular steep hillocks called "Teelahs," which have been planted largely with tea. The plains and undulating slopes of the hills have, however, been found better adapted to the plant, owing to the washing away of the surface soil from these isolated knolls.

The rainfall here is greater than in Northern Assam; that in Cachar averaging about 127 inches annually, and in Sylhet about 160 inches.

Cherapunji, on the hill slopes which separate these districts from Northern Assam, has the reputation of being the wettest place in the world, and has a rainfall which exceeds 500 inches in the year.

The tea plant was discovered growing wild in Cachar in 1855, and in Sylhet in 1856. Cultivation immediately followed, and steadily advanced in Cachar; but in Sylhet there were in 1875 only twenty-three gardens with 4446 acres under mature plants. During recent years, however, much attention has centred upon this district, and cultivation has advanced with rapid strides.

Railway communication seems probable, Government having approved a scheme for the construction of a line to pass through Cachar and Sylhet, and connect the coal-fields in Luckimpore with the sea-coast of Chittagong.

DARJEELING AND TERAI.—The peculiarly delicate flavour of tea from this district is unrivalled; it is the distinguishing feature of the district, but more especially of Darjeeling, and is so highly prized that the choice descriptions from favourite estates command extreme prices in the London market. The tea from here is generally known as "Darjeeling Tea," and is largely used for drinking unblended; there was a considerable sale for it at the Exhibition, where it was unquestionably much appreciated.

The peculiar fragrancy is probably attributable in a great measure to the altitude of the estates; these are mostly situated upon the lower slopes of the Himalayas, and the elevation of many of them is about 5500 feet above sea-level. The first regular tea garden was opened in 1856; in 1875 there were 121 gardens with a cultivated area of 22,162 acres, giving an outturn of 4,600,758 pounds.

The district is well situated for labour, which is derived chiefly from Nepaul.

The Darjeeling Himalayan Railway climbs the mountain steeps, and in its progress through the tea gardens affords views of magnificent scenery, which draw many visitors to the neighbourhood when the tropical summer renders the plains unbearable to Europeans. Through the junction with the Northern Bengal Railway, Calcutta is reached in twenty-four hours.

The DOOARS, situated near the Terai, at the foot of the Darjeeling Hills, has only recently been opened up as a tea district. The rich full liquoring character of the tea, combined with the varied facilities of the situation, render a considerable increase probable in the cultivation.

CHOTA NAGPORE has a dry climate which is somewhat deficient in rainfall. Its chief advantage lies in its proximity to the labour fields of Bengal. The production of tea is comparatively insignificant, amounting in 1884 to only 347,253 lbs.

CHITTAGONG is interesting from its nearness to the sea; proving that the plant can be cultivated on coast land. Tea seed was received from Assam in 1840, and in 1872 thirteen gardens existed, with a cultivated

area of 1203 acres, which had increased in 1884 to 2585. The thick dark liquoring qualities of many of its teas are much appreciated, and a high reputation attaches to some of its gardens.

KANGRA VALLEY, KUMAON, AND DEHRA DOON produced in 1884 only 2,576,532 lbs. of tea, 740,923 of which was green tea. The consumption of tea from these districts by Europeans throughout India is large; a few years since, considerable quantities were also purchased for the markets in Central Asia. A certain similarity exists between the produce of these districts; but with the exception of Kangra Valley, the export to Europe is not large, the distance from the sea-coast and the absence of convenient and inexpensive mode of transport being a serious drawback to shipment.

Kangra Valley tea is esteemed for drinking alone in England, on account of its fine and delicate flavour. In some of the Continental markets there is an occasional demand for it, probably owing to the above-mentioned quality, together with the fresh malty smell, and the black colour, of the curly and crapy leaf when in its dry state. The land here is subdivided into a large number of small tea gardens; in 1884, 1925 of these had a cultivated area of only 8172 acres. The commencement of the industry dates from about 1847.

Kumaon is interesting from the attention bestowed upon it by Government in 1834, which led to the establishment of nurseries for the China plant in the following year.

The Dehra Doon lies at the foot of the Hill Station of Mussourie, on the lower slopes of the Himalayas. The plant was introduced in 1842.

In none of these districts has the enterprise met with that encouragement by which it was fostered in the Provinces of Assam and Bengal.

NEILGHERRY teas have a very delicate flavour, but are wanting in strength—they are largely used for local consumption amongst Europeans in India; there is also a sale for them in their pure state in Great Britain. Tea is chiefly grown on the plateaux of Conoor and Ootacamunde, at elevations ranging from 4000 to 7000 feet above sea-level. The first tea garden opened here was in 1851. The rainfall varies from about 70 to about 90 inches annually.

TRAVANCORE was not represented at the Exhibition. This is quite a new district for tea; some parcels recently sold in London were of good quality.

The labour question.—The difficulty of procuring cheap and efficient labour has always been serious. In very few of the tea districts can the local population be relied upon to work. It has therefore been necessary to import coolies from the densely populated labour-fields, situated in the neighbourhood of Chota Nagpore, in Bengal. The restrictions placed upon employers of labour, together with the initial expenses attendant upon immigration, have long been a source of grievance to the planters. Increasing familiarity with the conditions of life in the tea districts is now stimulating the progress of free immigration.

Machinery has done much to mitigate the difficulties of the labour question. The important offices of rolling the leaf, drying or firing it after rolling, and sorting it into the various grades, ready to pack into the chests, are all performed by efficient machinery. The crucial operation of withering the fresh green leaf, which is especially difficult under the

frequently unfavourable conditions of an atmosphere saturated with moisture, has lately occupied much attention. The solution of the difficulty is likely to have an important bearing upon the character of the tea, especially regarding the attainment of improved and more uniform quality under all conditions of weather.

The supply of wood for fuel and for packages was at one time a cause for anxiety. The former difficulty has to a certain extent been overcome by the discovery of coal in Assam. Planks for tea boxes are now largely sawn in the districts by local mills, but the diminishing supplies of timber in many places render the importation of planks necessary from Burmah and elsewhere.

Cost of production is much influenced by the labour question and the transport facilities, and varies greatly in different localities. Generally speaking, the introduction of machinery, the increased experience resulting in more perfect system and greater economy, together with the improved transport, have effected large savings in the cost of production. These reductions have entirely kept pace with the severe fall in prices, so much so that many large tea companies were actually paying better dividends, at the average price of *1s. 2d.* obtained in 1885, than they were able to do some years since, when the average price was nearly *2s.*

Yield per acre varies considerably, but is highest in Assam, where in Luckimpore there are several large gardens with an outturn of 800 lbs. per acre; in this district the average for the 25,881 acres under mature plants in 1884 was 437 lbs. In Durrung, Nowgong and Seebsaugor, there were in the same year 61,541 acres under mature plants, giving an average yield of 335 lbs.

Available land.—Although in some districts the most suitable localities have already been planted, there still remains an abundant supply of good land in various places which may be leased from Government. In Luckimpore, where the yield is largest, vast tracts are still uncultivated.

CEYLON.

Ceylon is our only Colony where tea is extensively cultivated. The development of the industry is of such recent date that only a fractional part of the cultivated area is as yet in full bearing. At the present time the acreage is computed at about 130,000, the great bulk of which has been planted during the last few years;—hence the yield, although comparatively small at present, is rapidly increasing. The history of the enterprise is peculiarly interesting, and strikingly exhibits the pluck and endurance of the Colonists.

Origin.—China tea was grown in the Botanical Gardens at least as early as 1824, and plants were again received into the island in 1842 or 1843. About 1867 or 1868 the Assam Hybrid was introduced and planted experimentally in the Botanical Gardens, and upon one or two estates. Tea was first made for export in 1872. Little attention was however paid to the industry at that time. Coffee was the staple product

of the island, and was so lucrative that it seemed to be inaugurating a golden age. As acre after acre was planted up, the prosperity of the planters continued to increase. Land rose from a few shillings an acre to prices which a short time previously would have been looked upon as fabulous. Money literally poured into the coffers of the owners of these gold-bearing estates. Then came a change; a fearful disease overspread the coffee, and desolated the country. The hopes of the planters were blighted—their plantations ruined, fortunes lost, and sources of income suddenly cut off. It was in this dire predicament and under the cloud of so fearful a calamity that the resources of the impoverished Colonists were put to the test. They were driven to search for some new industry which should recoup their disastrous losses and provide a livelihood for the future. It was then that, having tried cinchona, cardamums, cocoa, and other products with varying success, they turned their attention to tea. The plant was found to grow luxuriantly even in the midst of the diseased coffee, and proved impervious to the terrible blight, by which it was passed by unscathed. Cultivation was soon started in earnest. The plant flourished not only at sea-level and in low-lying valleys, but on mountains 6300 feet in elevation: in districts where the annual rainfall was 170 inches and the mean temperature was 80°; and in localities with a rainfall of only 70 inches and an average temperature of about 60°.

Development.—Cultivation increased so rapidly that the exports rose from a few pounds in 1873 to 4,352,895 in 1885, and during the first ten months of 1886 they amounted to 6,750,000 pounds.

Ferguson's Directory gives the area planted out as follows:—

Year . .	1867	1868	1869	1872	1873	1874	1875
Acres . .	10	200	50	10	250	350	1080

The following table gives the acreage under cultivation and the quantity exported since 1876, with the approximate average price obtained in the London market since 1880:—

	Cultivated acreage.	Exports in pounds.	Approximate average price. s.	d.
1st October 1875 to 30th September 1876	1,750	282		
,, 1876 ,, ,, 1877	2,720	1,775		
,, 1877 ,, ,, 1878	4,700	3,515		
,, 1878 ,, ,, 1879	6,500	81,595		
1st January 1880 to 31st December 1880	9,274	114,845	0	10½
,, 1881 ,, ,, 1881	13,500	311,145	0	11⅛
,, 1882 ,, ,, 1882	22,000	621,068	1	0¼
,, 1883 ,, ,, 1883	32,000	1,599,687	1	3¼
,, 1884 ,, ,, 1884	67,000	2,285,294	1	2⅝
,, 1885 ,, ,, 1885	102,000	4,352,895	1	3¼

Quality.—In spite of increasing quantity the average price during these years showed an advance, although the value of tea generally was declining—a sure proof of the high appreciation in which Ceylon tea is held. While possessing a mellowness of its own, it somewhat resembles a mixture of Indian and China tea, a favourite blend which has for many years been gradually taking the place of China tea, unmixed. The diversities of flavour are very great and often peculiarly delicate; in many of the teas

considerable strength is combined with an agreeable richness. Teas grown at high elevations are more noted for their delicacy of flavour, and those in the lower-lying districts for the strength of the infusion. The differences in character range between a resemblance to good China tea on the one hand, and some similarity to Indian on the other.

The Exhibition.—In the Exhibition, Ceylon tea was well represented by 624 samples, shown by 167 different estates. In the Ceylon Court three handsome satin-wood cases contained specimens exhibited by thirty-six representative factories, each showing the three principal grades used in commerce: Pekoe, Broken Pekoe, and Pekoe Souchong. Various other samples were neatly arranged in the Court, the most noticeable being some specimens of peculiarly handsome golden and silver Flowery Pekoe, and six samples of native-grown tea marked "Carolina Tea."

In addition to the above, in the North Court was a "Trophy" which contained in glass vessels 459 samples from 145 estates, representing the chief grades usually prepared, besides some particularly handsome "Exhibition" teas.

That Ceylon possesses the ability to produce excellent tea is indisputable. Her chief object should now be to maintain that high standard of quality which has gained for her produce such well-merited distinction. At times the quality has fallen off, but this deterioration has hitherto been only temporary, lasting at most for a few months—a vicissitude not peculiar to Ceylon. It has probably been caused by the operation of pruning, adverse weather, or the desire to gather more leaf than was warranted by the strength or age of the plant. It must also be remembered that amongst the hundreds of estates recently brought into bearing, it has been difficult for every planter to gain an immediate mastery over all those minutiæ of detail which are essential to the successful manufacture of a perfect tea. Probably, with the more general introduction of scientifically-applied machinery, greater accommodation for the manipulation of the gathered leaf, and a fuller supply of the necessary power for dealing with it immediately after plucking, a marked improvement will be shown in the quality from some of the estates.

Climate.—It is generally admitted that the climate is far more suitable for tea than for coffee. The abundance of moisture renders the island more fitted for a leaf crop than a fruit crop, while the alternate vicissitudes of sunshine and rain but increase the luxuriance of the tea shrub, and encourage in the leaves that abundance of sap which constitutes their greatest value. The annual rainfall, which is generally well distributed, varies from about 70 inches to over 200 inches, and the mean temperature ranges between about 60° and 80°.

Soil.—Speaking generally, the soil of Ceylon cannot be called good. Although in exceptional cases it may be rich, there are other localities where it is decidedly poor. It is generally of a light friable nature, admitting of easy penetration by the long tap-root of the tea plant. It is probably owing to its capacity for deep feeding that tea has been found to do well on abandoned coffee plantations, where it finds ample nourishment in the stratum of sub-soil which had remained unpenetrated by the root of the shallower-feeding coffee shrub. In reference to depth of soil and the suitability of this sub-soil to the tea plant it may be well to mention that when land has been deeply cut, as, for instance, in making roads, the roots

have been observed 6 to 8 feet below the surface—and that even in stiff clayey soils; had anything in the soil been uncongenial to the nature of the root, it would have turned upward, as in certain soils coffee was wont to do, and the effect upon the plant would have been probably most injurious to its productive powers. It is worthy of remark that more than one estate noted for the excellence of its tea is situated upon very poor soil, while one or two famous estates, besides many other well-known gardens, have risen upon the ruins of worn-out coffee plantations, the soils of which had, from exhaustion, ceased to yield coffee productively. Although it is probable that manure will be found necessary, it appears that whatever is lacking in the soil * is more than counterbalanced by the genial and forcing nature of the climate. Those districts which, owing to insufficient drainage, have suffered most from the washing away of soil during excessive rain are of course the most impoverished, and the least adapted to any cultivation.

Adaptability of the tea plant.—It is remarkable that where coffee has been left untended it has been invariably found quickly to sicken, and generally to die. Tea, on the contrary, though neglected and allowed to struggle for existence in the midst of the exuberant jungle vegetation, instead of being choked, is found not only to hold its own but absolutely to thrive in this wild state, and triumphantly to assert itself over the dense tropical undergrowth, which rapidly follows a cessation of cultivation. Dr. Trimen, the Director of the Botanical Gardens, mentions a plantation grown from Assam Hybrid in 1867–1868 in the Botanical Gardens at Peradeniya, where the plants were left quite to themselves, and grew up under the shade of large trees. In 1882, owing to the great demand for seed, he reduced many of them to a convenient height—several of them being as much as 50 feet in height.

Labour is supplied by the Tamil population who have immigrated from the neighbouring coast of India, whence they are continually obtained; they are a docile and tractable people, well suited for work on estates. The net average cost of labour is about sixpence per head per day. Men, women and children are employed in picking the leaves, and in various other operations upon the gardens.

Transport to port of debarkation is performed chiefly by good roads, which run at convenient intervals; a railway also passes through a portion of the tea districts, in addition to which some have also the advantage of river transport.

Freight to London is moderate. Ceylon being situated in the routes of numerous lines of steamers, competition reduces the probability of excessive rates.

Enemies.—Fears are often entertained that the fungus which devastated the coffee plantations will ere long commence its terrible depredations upon tea. No botanist would entertain such fears. The authority of Dr. Trimen may be quoted that such a calamity is an impossibility, the nature of the tea plant being totally unsuitable for that particular fungus. As stated elsewhere, tea will *flourish* in the midst of diseased coffee. There is no doubt

* Some interesting analyses of Ceylon soil have been made by Mr. John Hughes, of 79, Mark Lane, and are published in the *Ceylon Observer* of 31st August, 1886. Mr. Hughes has also written a book entitled "Ceylon Coffee Soils and Manures," which is replete with information useful to those interested in tea cultivation.

that enemies to the plant must and do exist both in Ceylon and elsewhere, but tea has hitherto in all countries exhibited a strange immunity from disease. The ravages of such insect pests as red spider and white ants are not peculiar to Ceylon, and are too well known and understood to create alarm.

Caution.—As it is an ascertained fact that excessive planting of *any* vegetation is liable to induce pest of some kind, caution would suggest the introduction of other plants which should separate adjoining estates, and thus minimise the risk, in the event of *any* blight appearing.

Short crop means light expenditure.—Tea cultivation possesses an advantage which renders it in one respect a safer investment than coffee and many other products. The principal item of expenditure, after once an estate has been brought into bearing, consists in plucking the green leaf and preparing it for market; half the annual outlay is absorbed by these harvesting operations. Hence when the yield is short, the expenditure is of necessity proportionately curtailed.

Acreage available.—Although it is difficult to form a definite idea of the area suitable for tea, it is the opinion of competent judges that several hundred thousand acres are adapted to its growth.

Yield per acre.—It is early yet to form a reliable estimate of the yield per acre, but experienced planters hope for a return of 400 to 600 pounds on favourably situated estates when in full bearing. This amount has been much exceeded in some cases.

Future production.—The production three or four years hence is estimated at about 35,000,000 pounds. Reckoning the average outturn of the 130,000 acres already planted as low as 250 pounds, and allowing for increasing cultivation, this estimate does not appear too high. Taking into account the annual increase of some few million pounds from India, the probable supply of tea to be dealt with in a few years becomes sufficient to warrant apprehensions of a serious contraction in values. In the event of over-production two courses suggest themselves as remedial.

1st. To work for quality in preference to quantity.

2nd. To open up new markets for tea.

1st.—Quality.—Those estates which produce tea of the highest quality will probably be best able to withstand any severe depression in values, because inferior teas are sure to be in abundance. Qualities which rise above the ordinary level are therefore most likely to be sought after. These will probably be found to emanate from the most scientifically and economically managed estate.

Analyses.—In view of the importance of a thorough comprehension of the nature of a perfect infusion, some analyses are appended. These were kindly afforded by Mr. John Hughes, of 79, Mark Lane, at the suggestion of Mr. J. L. Shand, the Commissioner for the Planters' Association of Ceylon. It will be noticed that the most valuable tea contains the largest proportion of tannin; this tea was grown upon poor soil.

Nos. 1, 2 and 3 are Broken Pekoes; although differing somewhat in amount of tip, the valuations are calculated only by the quality of the liquor.

No. 1. Broken Pekoe, with very strong, dark, full liquor, of excellent quality, which becomes cloudy on cooling. Value *2s. 6d.* per lb.

Grown at an elevation of about 2500 feet, on poor soil, which would

have been condemned for coffee. Sub-soil of a stiff clayey nature. Annual rainfall about 200 inches.

No. 2. Broken Pekoe, with fine, delicate-flavoured liquor, rather wanting in strength. Value 1*s.* 5*d.* per lb.

Grown at an elevation of about 6000 feet, upon dark peaty soil with no clay. Annual rainfall about 70 inches.

No. 3. Broken Pekoe, with a flavoury liquor of good quality, and fairly dark colour. Value 1*s.* 7*d.* per lb.

Grown at an elevation of 4400 to 4800 feet in a friable soil, with good natural drainage. Annual rainfall about 100 inches.

No. 4. Pekoe Souchong, with a flavoury liquor of good quality, but rather wanting in strength. Value 1*s.* 1*d.* per lb.

Grown upon the same estate as No. 3.

	No. 1.	No. 2.	No. 3.	No. 4.
Water-dried at 212° F.	5·58	7·70	5·06	5·00
Oil and chlorophyll	2·30	2·85	3·15	2·95
Resin	2·55	0·70	2·85	1·45
Tannin, sugar, mucilage, fibre, albuminous compounds	83·69	84·51	83·74	85·78
Mineral matters *	5·88	4·24	5·20	4·82
	100·00	100·00	100·00	100·00

* Consisting of:—

Potash	2·16	1·82	2·11	1·94
Soda	0·30	0·49	0·24	0·09
Phosphoric acid	0·75	0·78	0·89	0·74
Silica and quartz	0·78	0·14	0·24	0·06
Lime, magnesia, iron and manganese, chlorine, &c., sulphuric acid	1·89	1·01	1·72	1·99
	5·88	4·24	5·20	4·82

		No. 1.	No. 2.	No. 3.	No. 4.
	Water-dried at 212° F.	5·58	7·70	5·06	5·00
1	Extract soluble in hot water during first ten minutes	30·62	27·25	29·09	26·45
1	Extract soluble in hot water during second ten minutes	7·10	6·65	7·30	7·05
2	Insoluble matter	56·70	58·40	58·55	61·50
		100·00	100·00	100·00	100·00
1	Containing soluble nitrogen	1·88	1·51	1·66	1·61
2	Containing insoluble nitrogen	2·69	2·83	2·82	2·84
		4·57	4·34	4·48	4·45
	Containing tannin, soluble in the first ten minutes' infusion with hot water	15·62	10·65	9·94	12·42

The second table is especially interesting from its showing the amount of extract obtained during two separate infusions in hot water.

2nd.—New Markets.—The following list of various tea-consuming countries, with the quantity annually consumed per head of population, is suggestive of new fields for the industry. Almost the entire amount taken in America is drawn from China and Japan. Could not Ceylon tea be

gradually introduced into this important market? The figures in the list are based chiefly upon an average of five preceding years :—

		Annual consumption in English pounds.	Annual average consumption per head of population in English pounds.
Australian Colonies		18,018,000	7·66
New Zealand		3,902,000	7·23
Tasmania	about	699,500	5·35
Great Britain	1885	182,409,000	5·02
Newfoundland		824,000	4·38
Canada		16,600,000	3·69
Various British possessions	1884 about	3,930,000	1·66
United States	about	65,000,000	1·30
Holland		4,382,500	1·05
Cape Colony		1,128,500	0·90
Natal		327,300	0·76
Russia		62,408,500	0·61
Denmark		746,000	0·37
Argentine Republic	1883–84	900,000	0·30
Persia	1884 about	1,043,000	0·13
Portugal		561,000	0·12
Switzerland	1880–82	292,000	0·10
Norway		170,400	0·09
Germany		3,113,500	0·07
Morocco	about	354,000	0·06
Belgium	1883	203,000	0·03
Sweden	1880–83	139,250	0·03
Austria-Hungary	1883–84	739,500	0·02
Spain	1884	136,000	0·01

NATAL.

Natal appears never to have seriously contemplated tea cultivation as a staple industry until fears were entertained of the failure of the coffee crop.

Although some few plants were obtained many years since from Kew, and an effort was again made to start the industry about 1863, little actual progress was made until 1877, when Assam Hybrid and Assam Indigenous seed was imported from Calcutta. The enterprise has since continued to increase, and there are now some twelve or thirteen tea estates, comprising a cultivated area of nearly 500 acres. Mr. Morton Green, the Assistant Executive Commissioner for Natal, states that in 1884 over 50,000 pounds were produced and disposed of on the local market. During the present year, 1886, some parcels have been exported to London and sold in Mincing Lane.

The thirty-seven samples shown in the Natal Court are representative of teas ordinarily used in commerce. They are indicative of much promise for the future success of the enterprise. Good seed has evidently been planted, and much care bestowed upon the manipulation of the tea. The dry leaf is for the most part well made, and bears evidence not only of a knowledge of manufacture, but also of careful supervision. The liquors are of fair

useful quality, and possess the elements for excellent tea. As a rule they are too highly fired or *burnt*, a fault which requires but to be known to be easily remedied.

Whether Natal will be able to produce tea at sufficiently low cost to allow a fair margin of profit if sold upon the London market, depends much upon the cost of labour in the Colony. It appears to be estimated that 7*d.* to 8*d.* per lb. is about the cost of made tea laid down in Natal, an estimate which it is expected will be reduced as the use of machinery becomes more general. Local markets will probably relieve the planters of all their supplies for many years to come, especially in the event of any sudden influx to the neighbouring regions, and the teas are well suited—when the overfiring is corrected—to the tastes of English settlers. Natal imports annually about 385,000 pounds of tea.

As to the adaptability of the Colony for tea cultivation, the fact of its doing so well is a strong testimony in its favour. The climate is peculiar; although the rainfall is low for a tea-growing country, this is supplemented by such excessive dew-falls that its want is not severely felt. These dew-falls deserve special notice, as their abundance adds much to the growing powers of the Colony;—the herbage in some localities, where it is protected from the burning rays of the sun, continuing moist until the day is far advanced. The price of land varies considerably; near the coast, where tea has chiefly been tried, it ranges from £2 to £5 per acre. Light sandy and rich chocolate-coloured loam prevails throughout the coast districts for about twenty miles inland. Labour is chiefly supplied by coolies who have immigrated from India, and of whom there are some 30,000 resident in the Colony; their wages average about 1*s.* to 1*s.* 6*d.* per day, everything included. The natives will now work with them at somewhat lower rates, and even the Zulu women are occasionally employed where kraals are situated upon the estates.

FIJI.

Of the numerous islands which constitute the Colony of Fiji, and comprise a total area of 4,751,360 acres, tea has as yet been only grown upon two of the islands, viz., Taviuni and Vanua Levu. It has only recently been introduced into the Colony. Some thirty acres were planted with Assam Hybrid seed in 1880 by way of experiment, the climate being found unsuited to the successful cultivation of coffee, and favouring the growth of leaf in preference to fruit crops. By degrees this plantation has extended into what is now known as the Alpha Tea Estate. It is situated in the island of Taviuni, at an elevation of 1000 feet above sea-level, and a distance of four miles from the coast. At the present time it comprises 300 acres of well-established tea, varying in age from one to six years, all in a flourishing condition, and promising excellent results to its enterprising proprietor.

The only other plantation—Masusu Estate—is in the island of Vanua Levu, three miles from the coast, at an altitude of 400 feet. It comprises

about 40 acres of tea planted with Assam Hybrid from Alpha Estate in 1884, and now coming on well.

The tea plant seems to thrive in Fiji. The sixteen samples exhibited comprise specimens of the principal grades of black tea, and amongst them some handsome golden Flowery Pekoe; they are mostly of excellent quality and possess a richness and flavour rather similar to fine varieties of Ceylon tea. They have been skilfully and carefully manufactured, and judiciously sorted into the various grades.

The soil of the principal islands is generally deep, easily worked, and is composed for the most part of volcanic lava, with basalt and conglomerate. The temperature and rainfall vary in different localities; in many districts there are as much as 150 to 180 inches of rain annually, pretty evenly distributed; but predominating during the first three or four months of the year.

The supply of tea is at present chiefly taken by the local market, but it is hoped that New Zealand and perhaps Australia will shortly relieve the Colony of any surplus stock which may be grown. The cost of land suitable for tea culture is at present about 20*s.* per acre. Labour is chiefly supplied by coolies and Polynesians, and averages about 1*s.* 6*d.* per day for each person, including all the incidental expenses attendant upon imported labour. Water-power is in good supply, and may eventually prove a great boon to the Colony.

JAMAICA.

The Director of the Government Plantations of Jamaica endeavoured as long ago as 1868 to test the suitability of the island for tea cultivation by planting about an acre as an experiment. The following record, taken from "The Report on the condition and progress of the Botanical Gardens Public Plantations, &c., for 1874–75," proves that these plants were flourishing at that date. "Fair samples of the Assam variety of tea have been manipulated. No plant in the island grows with more luxuriance and facility than this, and I see no reason why it could not be extensively grown. Many thousands of acres on the slopes of the Blue Mountain Range that could be obtained for a few shillings an acre are admirably adapted to this product."

In 1883 or 1884 another acre was planted with Assam Hybrid seed, and in 1885 Mr. D. Morris, the then Director of the Botanical Gardens, writes: "About 4000 plants of tea are under cultivation at the Cinchona Plantations at an elevation of 5000 feet. Seeds and plants are supplied to private planters, and a special effort is being made to establish a tea industry in the island;" and in the "Annual Report of the Public Gardens and Plantations for 1884," Mr. D. Morris writes: "I estimated that with indentured coolie labour, and an experienced planter from Ceylon or India, tea might be grown in the West Indies and placed in the market at a cost not exceeding 7½*d.* or 8*d.* per pound."

The only private tea estate is at Portland Gap, some 15 miles from Kingston, at an altitude of about 4500 feet. Twelve acres have now

been planted with Assam Hybrid supplied by Government, and the plantation is in a fair way of being established.

There is a large area suitable for tea cultivation in the centre of the island, extending for about 20 miles along the higher slopes on either side of the Blue Mountains, and comprising an average breadth of about ten miles, with an altitude varying from 3000 to 6000 feet. The soil here is metamorphic and volcanic. The annual rainfall averages about 100 to 105 inches. Water-power is in good supply. Transport to Kingston is not excessive. Labour averages about 1*s.* 6*d.* per day for each man, and about 1*s.* for every woman, employed upon an estate, all incidental expenses included.

Considering that the retail price of tea in Jamaica, including 1*s.* per lb. duty, averages 4*s.* 6*d.* to 5*s.* per lb., and that there is considerable difficulty in obtaining really good tea in the nearer Southern States of America, the planters should find a good market for their produce.

Jamaica imports about 23,000 pounds of tea annually. The four samples exhibited in the Jamaica Court are from the Botanical Gardens. They are delicate in flavour and of good quality, and show knowledge of manufacture and careful preparation, although the colour of the dry leaf is rather too grey. Pekoe Souchong is the only kind represented.

JOHORE.

The nine samples exhibited comprise specimens of Souchong, Pekoe Souchong, Pekoe and Orange Pekoe. The teas possess fair flavour, but are capable of improvement both in the infusion and in make of the leaf. This will doubtless follow as the process of manufacture becomes better understood.

About 300 acres are at present under tea cultivation; these appear to have been planted with Assam Hybrid seed not many years since. A few parcels of tea have recently been shipped to London and sold in the market.

The climate of Johore is hot and damp, with an annual rainfall of about 90 inches. The soil, except in parts, is not rich. Labour is now chiefly imported from India.

STATEMENT ILLUSTRATIVE OF THE STATE OF TEA CULTIVATION IN BRITISH INDIA DURING THE CALENDAR YEAR 1884.

Province and District.	No. of Plantation.	Acreage under mature plants.	Acreage under immature plants.	Total area under tea.	Acreage taken up for planting but not yet planted.	Approximate pounds.			Average yield in lbs. per acre of matured plants.
						Black.	Green.	Total.	
Assam. Brahmapootra Valley.									
Luckimpore	153	25,881	2,524	28,405	100,987	11,317,813	...	11,317,813	437
Seebsaugor	232	39,021	4,863	43,884	145,256	12,990,471	174,278	13,164,749	337
Durrung	126	13,269	3,410	16,679	40,831	4,384,141	...	4,384,141	330
Nowgong	70	9,251	1,600	10,851	60,099	3,055,395	18,720	3,074,115	332
Kamroop	87	5,546	797	6,343	18,557	960,668	...	960,668	173
Goalpara	8	267	228	495	1,017	83,621	2,000	85,621	320
Assam. Surma Valley.									
Cachar	183	46,299	6,064	52,363	171,677	12,570,979	7,520	12,578,499	272
Sylhet	111	18,624	12,208	30,832	102,294	5,350,761	209,832	5,560,593	298
Bengal.									
Darjeeling	170	29,127	6,395	35,522	10,916	7,955,987	...	7,955,987	273
Western Dooars	106	7,648	5,615	13,263	42,432	2,673,884	...	2,673,884	350
Chittagong, &c.	26	2,706	598	3,304	18,553	763,166	...	763,166	282
Chota Nagpore	36	2,276	1,333	3,609	4,962	347,253	..	347,253	152
Punjab.									
Kangra Valley	1,925	6,730	1,442	8,172	1,756	891,098	442,904	1,334,002	191
North-West Provinces.									
Kumaon and Garhwal	51	2,765	716	3,481	2,278	258,180	214,957	473,137	171
Dehra Doon	34	3,729	1,217	4,946	1,635	686,151	83,062	769,213	206
Madras.									
Neilgherries	72	3,414	543	3,957	3,449	395,960	...	395,960	116
Travancore	27	818	669	1,487	1,670	105,740	...	105,740	142
Sundry Districts	15	70	48	118	40	3,405	...	3,405	49
	3,432	217,441	50,270	267,711	728,409	64,794,673	1,153,273	65,947,946	303

TABLE SHOWING THE PERCENTAGE OF INDIAN TEA AND CHINA TEA USED FOR HOME CONSUMPTION IN GREAT BRITAIN DURING EACH OF THE LAST 22 YEARS.

	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Percentage of Indian	3	4	6	7	10	11	11	13	15	13	16
Percentage of China	97	96	94	93	90	89	89	87	85	87	84
	100	100	100	100	100	100	100	100	100	100	100
	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1885
Percentage of Indian	17	19	23	22	28	30	31	34	37*	39*	41*
Percentage of China	83	81	77	78	72	70	69	66	63	61	59
	100	100	100	100	100	100	100	100	100	100	100

TABLE SHOWING THE AVERAGE MONTHLY HOME CONSUMPTION IN GREAT BRITAIN OF INDIAN TEA AND CHINA TEA—IN POUNDS— DURING EACH OF THE LAST 22 YEARS.

	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Average monthly consumption of Indian Tea	lbs. 250,000	lbs. 382,000	lbs. 530,000	lbs. 623,000	lbs. 893,000	lbs. 1,125,000	lbs. 1,163,000	lbs. 1,388,000	lbs. 1,693,000	lbs. 1,544,000	lbs. 1,935,000
Average monthly consumption of China Tea	7,910,000	8,135,000	8,720,000	8,291,000	8,448,000	8,750,000	9,131,000	9,362,000	9,307,000	9,908,000	10,186,000
	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886
Average monthly consumption of Indian Tea	lbs. 2,145,000	lbs. 2,321,000	lbs. 3,062,000	lbs. 2,841,000	lbs. 3,653,000	lbs. 4,028,000	lbs. 4,208,000	lbs. 4,925,000	lbs. 5,351,000*	lbs. 5,741,000*	lbs. 6,222,000*
Average monthly consumption of China Tea	10,282,000	10,285,000	10,079,000	10,546,000	9,561,000	9,324,000	9,548,000	9,309,000	9,240,000	9,148,000	8,685,000

* Ceylon Tea is included with Indian Tea in the years 1884, 1885 and 1886, the deliveries of Ceylon Tea amounting in 1884 to about 1 per cent. in 1885 to about 1¼ per cent., and in 1886 to nearly 3½ per cent. of the whole.

INDIAN TEA COMPANIES (REGISTERED IN LONDON).

(Arranged according to Area of Cultivation.)

RESULTS OF WORKING IN 1885.

NAME.	Capital Paid up.	Present acreage of Cultivation.	Capital per acre.	Crop of 1885.	Yield per mature acre.	Cost of Tea per lb.	Value of Tea per lb.	Dividend on Crop. 1885.
	£		£	lbs.	1885.	s. d.	s. d.	per cent.
Assam Company	187,160	7,710	24	2,588,775	340	0 10	1 1	20
Land Mortgage Bank of India, Limited	327,750	7,597	43	1,698,201	262	0 10½	1 2½	nil.
Jorehaut Tea Company, Limited	100,000	4,360	23	1,113,891	291	1 0	1 4	15
Upper Assam Tea Company, Limited	194,224	2,456	79	1,016,962	414	0 11	1 1¼	nil.
Brahmapootra Tea Company, Limited	114,500	2,340	49	965,470	463	0 9¾	1 2	16
British Indian Tea Company, Limited	243,300	2,084	116	596,455	286	0 9¾	1 0¼	1¼
Noakacharee Tea Company, Limited	84,000	2,050	41	524,000	288	1 1¼	1 3½	nil.
Dooars Tea Company, Limited	106,000	2,040	52	405,138	356	0 9	0 11¼	8
Jokai (Assam) Tea Company, Limited	56,037	1,847	30	650,318	377	0 10½	1 1	10
Doom Dooma Tea Company, Limited	116,100	1,675	69	1,089,287	700	0 8¼	0 11¾	13¼
Darjeeling Company, Limited	135,420	1,661	81	511,037	307	1 0	1 5¾	8
Mungledye Tea Company, Limited	161,280	1,491	108	290,623	200	1 2½	1 1½	nil.
Jhanzie Tea Association, Limited	55,000	1,487	37	369,316	312	1 0½	1 5⅞	10
Lebong Tea Company, Limited	82,070	1,248	65	331,050	345	0 11	1 3¼	9
Panitola Tea Company, Limited	58,810	1,162	52	508,293	535	0 11½	1 2	10
Borelli Tea Company, Limited	78,170	973	80	310,695	417	0 11½	1 3¼	6
Luckimpore Tea Company of Assam, Limited	76,852	967	79	245,375	265	1 2¼	1 4¾	4
Borokai Tea Company, Limited	43,560	938	46	248,960	273	0 10½	1 6¾	16
Indian Tea Company of Cachar, Limited	94,060	800	117	247,360	341	0 9¾	1 4	6
Tiphook Tea Company, Limited	26,000	800	32	223,204	318	0 10	1 1⅝	10
Scottish Assam Tea Company, Limited	79,590	712	111	187,805	281	0 11½	1 4½	5
Dejoo Tea Company, Limited	43,580	626	70	223,939	434	0 10½	1 1½	6
Nassau Tea Company, Limited	36,000	574	62	158,645	276	0 9⅝	1 0⅝	4½
Moabund Tea Company, Limited	35,007	560	62	132,515	307	1 1½	1 3⅝	5
Aggregate Capital of the 24 concerns above named	£2,534,470	Total of acreage	48,158	Aver. capital per acre	£52	Total of crop	14,637,314	Average yield per acre	340lbs.	Average cost	0 11	Average value	1 2⅔	Average dividend	6%

COFFEE.*

By Henry Pasteur.

The total production of coffee in the world is roughly estimated at about 600,000 to 650,000 tons, of which Brazil alone produces between 340,000 and 380,000 tons, and Java 60,000 to 90,000 tons, the proportion of British-grown coffee being only about 35,000 tons, of which India contributes 15,000 to 18,000 tons, Ceylon 10,000 to 12,000 tons, and Jamaica 4000 to 5000 tons. Although numerically very small, the productions of our Colonies and of India occupy the front rank, owing to their excellence. Nowhere is finer coffee grown than in India and Jamaica, and its value, as well as that of Ceylon, is firmly established above that of all other kinds, even of Mocha, which at one time stood above all others.

A considerable amount of work and preparation has to be expended on coffee, from the moment it is picked from the trees until it is in a fit state to be sent to market. The berries, as may be seen from the numerous samples exhibited at South Kensington, are enveloped in an outer, coarse, thick, fleshy substance, the cherry, and an inner loose envelope of thin, hard skin, called parchment, from its resemblance to that substance. When allowed to grow to complete maturity on the trees, as in the case of Mocha, the cherry withers and dries, and is then easily removed by crushing or pounding, the berry inside having by that time become of a pale greenish or yellowish colour. The usual course, however, is to pick the cherry before complete maturity, when it is of a deep red or cherry colour, the berry inside being then found to be of a fine dark green or bluish-green, which it is the endeavour of the planter to preserve as carefully as possible, the value of his coffee depending chiefly on the depth and brightness of the colour. On gardens and plantations cultivated by Europeans, the cherry is removed as quickly as possible after being picked, being put through pulpers, and undergoing a very careful and delicate process of mashing and washing, until the berries are left with their parchment envelope perfectly clean. In many cases, however, there are neither appliances, nor time or labour, to put the fresh-gathered fruit through this process, and under a tropical sun the cherry dries quickly, and has then to be pounded, to the great detriment of the colour, as well as the quality of the bean; hence the difference between *unwashed* or ordinary pale, and *washed* or coloured or plantation coffee, the taste of the *washed* coffee being, as a rule, much more delicate, and free from the earthiness and common rough flavour of the *unwashed*. A large portion of the crops from Brazil, Java, St. Domingo, to a less extent Central America and Guatemala, in fact fully three-fourths of the world's production, are prepared as *unwashed* or pale coffee; whilst nearly the whole of the Ceylon crop, three-fourths of the Indian, and one-fourth to one-third of the Java, are prepared as *washed* or green coffee. The clean parchment

* In this Report India has been included.

has to be dried with the utmost care, and taken to the curing mills on or near the estate, or more generally at the port of shipment; it is then put through the peelers, which break the parchment, and remove as much as possible of the thin silver-skin adherent to the bean itself; then through sizers, which divide the berries into the various sizes, and after being hand-picked by a number of women and children, who remove the defective, broken, black, or light beans, the coffee is ready for packing in bags or casks for shipment. All those various operations require to be carried out with the utmost care and nicety, the slightest neglect or mistake in any one of them being liable to injure the quality to the extent of 5, 10, or even 20 per cent.

The above remarks, to some extent, explain the reasons for the superiority of British-grown coffee over that of most other countries, and also the great variety existing in the appearance, quality, and value of the samples exhibited by our various colonies and dependencies.

INDIA.

India now stands first and foremost amongst British possessions, both for the quantity and quality of its production. The samples prepared by the Indian Coffee Planters' Committee have been carefully selected in London from the earlier arrivals of the crop of 1885–6, and represent the produce of British plantations in the four chief districts of Mysore, Coorg, Neilgherry and Wynaad, as well as the less important one of Travancore. The exhibits from the three first-named districts are remarkable for their high average excellence, and for the presence of many of the points which, in the eyes of connoisseurs, constitute the nearest approach to perfection, viz., size, colour, smoothness, plumpness and weight of the berries. These coffees have always been, and are likely to continue, in high favour with the buyers for home consumption. Next to them come the Wynaad exhibits, which, if they lack some of the weight and fine shape of the others, are nearly equal in size, colour and smoothness, and find favour with home as well as export buyers. Travancore is a comparatively new district where plantations are generally at a lower elevation; it has suffered much of late years from repeated attacks of leaf-disease, which has destroyed many estates and weakened the trees on most others, and the result is seen in a small crop, deficient in colour, size and quality. Leaf-disease has likewise been raging in the other districts of India, to the serious detriment of crops, both in extent and quality; fortunately the severity of its attacks has greatly diminished during the past few years, and it has almost disappeared in many parts of the country. It has, however, in many places affected the vitality and shaken the strength of the trees, so that they have been less able to resist periods of drought or of heavy monsoon weather, and small and irregular crops have been the consequence. It would seem, however, as if plantations were gradually recovering their former strength, and with good cultivation and manuring and fair seasons India may hope to maintain its position as our largest and best field for

the production of fine coffee. A hopeful sign for the future may be gathered from the superior average quality of the crop of 1885–6 over that of the two or three previous ones.

Among the samples of Wynaad coffee, those from the Eva Estate deserve special attention, one half of that crop having been dispatched in parchment, to be peeled and sized in London. The experiment has proved quite successful, the coffee represented by the sizes 1st, 2nd and Peaberry, being fully equal in colour and appearance to the corresponding sizes prepared in India. The whole was sold at the same public auction, the London *cured* realising a rather better price than the other half. Similar and more recent experiments, made with some shipments from Costa Rica, Guatemala and New Grenada, have shown startling results, the portion prepared in London having realised from 10*s.* to 14*s.* per cwt. more than that cured in Central America. These experiments would tend to show that the parchment preserves in a remarkable degree the colour and the quality of the berry against the incidents or accidents of a land and sea transport. In the case of the Costa Rica and New Grenada shipments cured in London, the berries seemed fuller and of better shape and weight than the others, as if (which is by no means improbable) the parchment, left for two or three months longer than usual around the berries, had acted as a kind of natural preserver, inside of which the berry had time, as it were, to mature more completely than when deprived of its outer and inner coating almost immediately after being picked. The curing requires machinery, motive power, drying grounds, delicate manipulation, and constant supervision; where any of those requisites fail, the coffee suffers in appearance, and consequently in value. Suitable machinery for treating parchment has been erected at two of the London wharves; and there is every reason to hope that this is only the beginning of a new and profitable home industry. Growers will not be slow to perceive that the small increase of freight which they have to pay on parchment, is more than compensated by the enhanced price which the improvement in the quality of their coffee will enable them to obtain.

In addition to the produce of British plantations, India grows native coffee, chiefly in the districts of Coorg, Mysore, and Wynaad. Of late years the greater part has found its way to the French markets, where it is much appreciated, and latterly also to Trieste. It is a matter for regret that shippers from the Malabar coast have not sent any specimens of those kinds to the Exhibition; they are quite suitable for our home consumption, and form an important item of the Indian production.

Mysore is represented by 105 samples from twenty-seven estates; four samples—viz., *large size*, *bulk*, *small size* and *Peaberry*—being in most cases shown from each estate. Rather less than one-half appears to be of the true, rounded, heavy silver-skinned Mysore berry, the remainder partaking more of the character of the large, flat, deep-coloured Coorg type. This is the result of the extensive planting of Coorg seed, the old *chick* or Mysore tree having become weak and unable to bear fruit or to be propagated as easily as formerly; the hardier Coorg plants grow more quickly and yield larger crops, although not of such fine quality as the real Mysore plant. It would seem, however, as if the produce of the Coorg trees, on getting better acclimatised, showed some tendency to assimilate to the old Mysore, the finest and most esteemed of the Indian types. Of Neilgherry there are

twenty-four samples from seven estates; of Coorg, forty-five samples from thirteen estates; of Wynaad, nineteen samples from five estates; and from Travancore, eight samples from three estates; a total of 201 samples from fifty-five estates, besides twenty-eight samples in parchment or cherry.

Taking 90*s.* per cwt. as the average value of the *bulk* from the estates of true Mysore type, the *Coorg* Mysore estates would be worth 80*s.* for *bulk*, the Neilgherry 83*s.*, the Coorg 82*s.*, Wynaad 78*s.*, and Travancore 70*s.* per cwt.; whilst native Mysore of average quality would be worth 63*s.*, and native Coorg or Wynaad 60*s.* per cwt. The finest qualities of Mysore range in value from 100*s.* to 135*s.* per cwt.

The export of coffee from India in 1885 amounted to 328,317 cwt.

CEYLON.

When looking at the fine samples which were exhibited in the Ceylon Court in the neat barrels prepared under the direction of the Planters' Association, one could not avoid a feeling of sadness and regret at the thought that they represented only the fast vanishing remains of what was but nine years ago the most extensive and flourishing of the coffee crops raised on British soil by British enterprise and capital. The production which in 1873 amounted to nearly 1,000,000 cwt., declined to 665,000 cwt. in 1876, 312,000 cwt. in 1884, and 230,000 cwt. in 1885. The scourge of leaf-disease, a fungus (the *Hemileia vastatrix*) which first made its appearance in 1869, has gradually swept over the whole island, weakening the trees, undermining their crop-bearing capabilities, and leading to the gradual extinction of the plantations over many of the best districts. Coffee, however, has been able to maintain its ground in some parts, notably in Haputale, Badulla, &c., which are more favourably situated as regards soil and rainfall, and crops of from 150,000 to 200,000 cwt. may fairly be looked for for a few years to come, though it is not probable that cultivation can again extend in the island, as there is but little suitable forest land remaining unopened.

The variety known as Liberian coffee, which was planted extensively in the low country some years ago, under the belief that it would resist leaf-disease, has succumbed to it; besides which the quality is not appreciated in the home markets, on account of its coarseness, oily taste, and want of strength and aroma; and the prices realised for this sort are not likely to give a fair return to the growers.

Twenty-seven barrels exhibited by the Planters' Association of Ceylon, the produce of eight different estates, showed to what degree of excellence the preparation of coffee has attained in the curing establishments of Colombo. Three specimens from each mark—*large size*, *bulk* and *Peaberry*—were shown, the former ranging in value from 90*s.* to 105*s.*, and the latter from 87*s.* to 95*s.* The samples of *bulk* ranged from 75*s.* to 85*s.*, averaging 80*s.* per cwt., according to the depth and brightness of colour, smoothness and size, and weight and hardness of the berries; these latter characteristics vary according to the soil and height of the estates, high-grown coffee being

the most esteemed in the English market. Four barrels were shown of *low grown*, the produce of native gardens, cured and prepared like estate coffee, a very good and useful quality, though inferior in appearance and value to the produce of European plantations. Five samples were shown of pale or native coffee, extremely well sized and picked, and of an average value of 58*s.* per cwt. There were, further, five samples from two European plantations, and one of Liberian sort, of very large bean, smooth and well picked, worth 60*s.* per cwt., or about 8*s.* to 10*s.* per cwt. more than the average Liberian quality.

STRAITS SETTLEMENTS.

Coffee does not appear to be grown in the British Settlements of Singapore, Penang and Malacca, except in gardens and on a very small scale; but in the three Native States of Perak, Sungei-Ujong and Selangor, taken under our protection in 1874, its cultivation has been introduced, and some interesting exhibits from Perak testify to the adaptability of the soil and climate for its production.

In Perak, where mountain-ranges, reaching to 7000 feet, occupy a large portion of a well-watered country, a considerable acreage, above 1000 feet elevation, is reported to be suitable for coffee cultivation, whilst the Liberian sort thrives on the lower slopes and the plains. In Selangor, planting has only been introduced during the last few years, whilst in Sungei-Ujong estates have been established on the slopes of the Berumbun range, which rises to a height of 3000 to 4000 feet, and the cultivation of Liberian has been introduced on the lowlands. Of the fourteen exhibits from Perak, five are from the experimental hill gardens opened by Government; the sample marked *Hillgarden* is strong and full flavoured, and worth 90*s.*; those marked *Waterloo* and *Hermitage* have probably suffered somewhat in drying, being coarse and musty in the cup, and worth 70*s.* and 76*s.* Such kinds, if properly prepared on the spot, or in London, should the necessary appliances not exist at the plantations, and if perfectly sweet and clean, would supply an extremely good quality, suitable for home consumption as well as export, the coffee being, for size, colour, and general appearance, on a par with good Ceylon plantation. The climate, soil, and rainfall are all that can be wished on the Perak hills, but the great drawback hitherto has been the cost of labour, which, however, has now been arranged satisfactorily, and the difficulty of transport. One sample of large pale berries, very smooth, but out of condition and mildewed, would be worth 60*s.* if sound; two of Liberian, viz., Lindum Estate, in Sungei-Ujong, and Waterloo, were very large, and worth 53*s.* to 55*s.*; and three of ordinary Liberian quality, 48*s.* to 52*s.* per cwt.; the remainder consisted of parchment and cherry.

The growth of Liberian is not to be encouraged, for the reasons stated above under the head of Ceylon.

Samples of Bâli, Bonthyne and Philippine coffee, exhibited in the division of Straits Settlements, were probably not British-grown, but the produce of some of the Dutch islands in the neighbourhood of the Straits.

QUEENSLAND.

The climate and soil of this Colony appear to be well suited to the growth of coffee, which is found growing in various parts without any special care other than weeding. It is cultivated on some farms, but only as an adjunct to other crops, and the eight specimens shown in the Exhibition are such as should encourage its extension. A sample from Stanmore, Yatala, although not properly picked, showed a fair greenish quality, worth, as it is, 63*s.* per cwt., and which might probably be improved by cultivation and careful preparation. A sample from Buderum Mountain Mooloolah, was still better in quality.

FIJI.

A considerable portion of the interior of the islands of Viti Levu, Vanua Levu and Taviuni, appears to be well adapted for the cultivation of coffee. There is an abundance of rich soil, and favourable conditions of climate, moisture, &c.; the plant grows quickly and yields good crops. The pest of leaf-disease, which visited the islands four or five years ago, led to the destruction or abandonment of several estates, but now that it has disappeared, growers anticipate a prosperous future and increasing production.

Of fourteen samples exhibited, one showed a good quality of washed or plantation coffee, well grown and of large bean, but deficient in colour, and worth about 68*s.* per cwt.; one Peaberry, worth 75*s.*; one sound, though rather rough and discoloured, 63*s.* per cwt.; they were all three of strong, clean, good roasting quality. The remainder in parchment were somewhat similar, though mostly of a dark blackish colour, owing probably to insufficient drying.

NATAL.

Judging from the exhibits of Natal coffee, eleven in number, it would appear that the soil and climate of some portions of the Colony are eminently suited to its growth. The samples from Umzinto and Umzimkulu, to the south and extreme south of Durban, were of excellent quality, well prepared, heavy, round berries of good size and colour, and not unlike Coorg in appearance; such qualities would find a ready sale here for home consumption and export, and are worth from 73*s.* to 83*s.* per cwt. The samples from Tongaat and Riet Valley, in Victoria county, north of Durban, were also of useful quality, hard, greyish, roasting and tasting well, though not so well picked and prepared as the others, and rather deficient in colour; their value was from 60*s.* to 65*s.* per cwt.

The Natal plantations are mostly in the valleys and on the hill slopes along the sea-coast. The cultivation, begun some thirty years ago, had assumed rather large proportions in 1870 (there were then upwards of 4000 acres planted, and the annual production amounted to 12,000 cwt.); but disease of the trees and failure of crops have since led to the gradual abandonment of the plantations, and the produce now is not estimated at much more than 2000 cwt. annually.

In a country which can produce such fine coffee as that exhibited from Natal, there ought to be a promising field for future success open to the planter who devotes care and intelligence to the choice of the land, the quality of the seed, the growth and cultivation of his fields, and the preparation of his crop.

WEST AFRICA SETTLEMENTS—MAURITIUS.

The exhibits from Sierra Leone, the Gold Coast and Gambia were few in number and of poor quality, consisting chiefly of Liberian and of the small brown Casenga kind; the former worth 48*s.* to 50*s.*, and the latter 42*s.* to 45*s.* per cwt. One sample from the Gold Coast, raised at the Bâli Mission at Akropong, showed rather better quality of pale brownish native kind, worth 53*s.* per cwt. From the appearance of the samples, coffee seems to be cultivated in a very primitive way, and on a small scale only, and the varieties grown are those of lowest commercial value in the European markets.

From Mauritius, one sample of good yellow Liberian was shown, and from the Andaman Islands also one sample of Liberian of large size, both worth about 54*s.* per cwt.

WEST INDIES.

JAMAICA.—Coffee is grown in almost every one of the West India Islands, but Jamaica is the only one where the cultivation is carried out on an extensive scale, the quantity exported in 1885 amounting to 80,600 cwt., and occupying the third rank in value of the products exported from the island. From 8000 to 10,000 cwt. are produced annually on plantations situated on the high lands of the Blue Mountains, which have long been known as one of the finest coffee-growing districts in the world, thanks to a fine rich soil and a favourable climate, combined with all the care and intelligence which the means of European planters can command. The coffee from those favoured localities is all consumed in this country, and realises almost the highest prices in the market—say, from 90*s.* to 140*s.* per cwt. The remaining 60,000 to 70,000 cwt. are grown in various parts of the island; some in the *Manchester* district is of medium quality and well prepared, but the greater portion is cultivated in small patches or

gardens by settlers and small proprietors who do not possess the knowledge or the means of preparing their crops properly, or in the low country, where an inferior quality is raised; hence the great difference in prices between *fine mountain* and the *ordinary* Jamaica. The want of proper curing establishments is much felt in many parts; it is probable, too, that the plants are not raised from good seed, and that better cultivation and manuring are needed. But even this will not suffice to ensure the good quality of the crop, unless due attention is paid to picking at the right moment, and to immediate pulping and thorough drying of the parchment. This should ensure the proper colour, but, in the absence of the necessary appliances, the planter would best consult his interests by sending his parchment to be peeled, &c., at the nearest works, or better still, by shipping it to London for treatment. Ordinary Jamaica coffee is now selling here at from 50*s.* to 53*s.* per cwt., and there is every reason to believe that with better care in picking and curing, and with quick dispatch of the parchment to London, the grower might obtain from 10*s.* to 12*s.* per cwt. more than he does at present. There does not seem to be any good reason why, in a country where the highest priced coffee is grown, the bulk of the production should rank on a par with common Brazil or the lowest known qualities.

The extensive planting of the Liberian variety, which appears to be going on in Jamaica and other places, will most probably lead to disappointment; the quality is so poor, so deficient in strength and aroma, and so little appreciated in the home markets, that any material increase in the supply must inevitably lead to a lower range of prices, which will fail to repay the outlay.

The Jamaica plantations appear to have been so far quite free from leaf-disease, flies, or other enemies of the coffee-tree, and there is an abundance of forest lands of proper elevation in the St. Ann and Clarendon districts and the northern slopes of the Blue Mountains, suitable for extending the cultivation of the finer classes, which ought to give handsome returns for the capital so invested.

Of the sixty-nine samples exhibited in the Jamaica Court, sixteen were *parchment* and *cherry*, nine from the finest estates were worth from 110*s.* to 140*s.* per cwt., averaging 120*s.* to 125*s.*; eight average 90*s.* per cwt.; eight more 75*s.* per cwt.; eight were worth from 54*s.* to 65*s.*; and two about 47*s.* There were also twelve samples of Peaberry from 70*s.* for the lowest to 105*s.* for the best; and two samples of *Liberian* worth 56*s.* and 50*s.* per cwt.

In addition to the above, ten samples were shown in the *Indian Court*, mostly duplicates of some of the finest estates, and twenty-seven jars of average samples, also from the finer marks, of extremely good quality, and of a value not less than 120*s.* per cwt.

Proceeding from Jamaica in a south-easterly direction towards the continent of South America, I found amongst the British West India Islands which have sent specimens of coffee to the Exhibition :—

ST. KITTS AND NEVIS, with two samples of nice palish green, soft quality, worth 60*s.*

ANTIGUA.—Two samples of pale greyish, somewhat uneven, worth 54*s.*

MONTSERRAT.—One sample ordinary native kind, 50*s.*, and one greenish, of good size, 58*s.*

DOMINICA.—Coffee was at the beginning of this century the leading article of export from this island, and it was then considered one of the best kinds produced in the West Indies. The trees, however, were attacked some forty years ago by an insect blight which spread devastation among the plantations, and destroyed the greater portion of them, so reducing the production that at the present time it is hardly equal to the consumption of the island. Cultivation is now reviving to some extent, and it appears that the blight, although still in existence, is comparatively harmless at high elevations. The Liberian variety has also been introduced. There is an abundance of fine forest land and rich soil on the slopes of the bold mountains which cover the country, with plenty of moisture, conditions which are eminently favourable to the growth of coffee.

Of the ten samples exhibited, two were of very small, hard, heavy, greenish bean, worth about 70*s.* per cwt., one pale native kind 50*s.*, one Liberian 52*s.*; the remainder were of good size, greenish to rather good green colour, and if properly picked and prepared, would be worth from 63*s.* to 76*s.* per cwt. As it is, they were of very indifferent quality in the cup, and not worth more than from 56*s.* to 68*s.*

ST. LUCIA.—One sample, small close brownish, native kind, 52*s.*

BARBADOS.—One sample, ordinary pale uneven native sort, 52*s.*, and one sample of very well prepared good bluish plantation, of even size, though a little rough, worth 80*s.* per cwt.

GRENADA.—One sample, large pale greenish, useful quality, 54*s.*

TOBAGO.—Two samples of dull greenish and brownish Creole coffee, not sized, but good of its kind, 56*s.* to 58*s.* per cwt.

TRINIDAD.—Ten samples were exhibited: two of them consisted of very common dull brown and red badly prepared coffee, worth 47*s.*; four were Creole or pale native kind, of a useful quality, ranging in value from 52*s.* to 54*s.*; the others were better, and with more care in their preparation might be turned into good coffee, worth probably 60*s.* or 70*s.*; but being imperfectly picked and of a brownish colour, their value was reduced to 58*s.* to 60*s.* per cwt.

There appears to be a good deal of land suitable for opening into coffee gardens or plantations, and planting has been carried on lately on a larger scale. It is to be hoped that the Botanic Gardens, which supply plants from their nurseries, will endeavour to provide none but those grown from the best seed of *Coffea arabica*, which can easily be procured from Jamaica or from New Grenada. In an island where the cultivation and preparation of cocoa has been brought to such a degree of perfection, there ought to be no lack of skilled labour to prepare coffee much better than is apparent from the samples exhibited. The shape and size of the berries show that the soil and climate are favourable, and that it is only labour, care and skill which are required to give the coffee its proper value.

BRITISH GUIANA.

British Guiana, situated on the north-east coast of South America, comprises the Colonies of Essequibo, Demerara, and Berbice, the two latter well known some forty or fifty years ago as producing coffee of esteemed quality. The cultivation, however, diminished steadily, until in recent years of Demerara or Berbice coffee the name alone remained. The decrease is ascribed more to cost and want of labour than to climate or soil, which are both favourable; and the few samples shown, from plantations which have again been started in the last few years, tend to prove that excellent coffee can be grown in the colony. The cultivated part of the country is a flat alluvial plain of forty miles extent, between the sea and the rising ground, at and even below the sea-level, and traversed by large rivers; cultivation is restricted to the river banks and the coast.

Of the six samples exhibited, three of extremely useful pale bean, very well prepared, would be worth 58*s.* to 63*s.* per cwt., if perfectly clean and sweet and unaffected by sugar, which is not the case with the samples shown; one was Peaberry and two Liberian, of average sort, valued at about 45*s.* to 52*s.* per cwt.

BRITISH HONDURAS.

Coffee cultivation does not appear to have begun until within the last four or five years, when one or two plantations were established. Probably not more than a few hundred acres are planted; but *Coffea arabica* grows wild in some parts. Two bags were exhibited of very good pale greenish native kind, strong and roasting well, worth 63*s.* per cwt., and one sample of parchment. The adjoining State of Guatemala is gradually becoming one of the leading coffee-growing countries, and British Honduras should be a very suitable place for a more extended cultivation.

In concluding this report it is difficult to avoid alluding to the extraordinary treatment to which coffee is subjected at the hands of the British Government. Had it had extended to it the same amount of fair play and protection against fraud as is accorded to Tea, it is probable that the greater portion of the 35,000 tons of British-grown coffee would be retained for home consumption, instead of a paltry 14,000 tons, or at the rate of about 15 ozs. per head of population per annum, against 2¾ lbs. per head in France, 5 lbs. in Germany, 7¾ lbs. in the United States, &c. It would almost seem as if the Treasury, which is directly responsible for the legislation on the subject, was bent upon discouraging by every means in its power the use of one of the most delicious and beneficent of the non-alcoholic drinks, by the sanction which it gives to its adulteration with *any vegetable matter;* it is impossible to recognise coffee in the wretched mixtures which are sold in every shop or store, or in the thick dark liquid

which is served under that name in many of the coffee palaces and temperance houses throughout the kingdom. No wonder that consumption decreases year by year, not of coffee alone, but even of chicory and mixtures. The Local Government Board and the Board of H.M.'s Customs join, in their annual reports, in ascribing the diminishing revenue from coffee and chicory to adulteration, and in condemning the present state of legislation on the subject. Surely those who are engaged in the cultivation, importation and trade in coffee, ought to combine to make an effort to obtain redress for what is acknowledged almost on all hands to be a crying injustice.

COCOA.

By HENRY PASTEUR.

COCOA or cacao is the prepared fruit or seed of a tree originally discovered in the tropical portions of America. The botanical name is *Theobroma cacao.* The fruit is enclosed in a pod, measuring 7 to 10 inches long, of which specimens and models were shown in the West Indian and Ceylon Courts, and it is on the treatment to which the seed is subjected that its value as an article of consumption depends.

Cocoa, unlike coffee, requires no expensive machinery for its preparation: wooden boxes for the fermentation, and wooden platforms for the drying, covered with a movable shed, are all that is wanted; and it is strange that such a large proportion of our West India Colonies should ship their produce without using these simple means of curing properly.

There are several modes used in our Colonies for curing cocoa, to render it fit for shipment to the consuming countries. The simplest method is to take the pod, and stripping it from the seed, wash the seed and then dry it in the sun. The better plan is to place a quantity of seed, still enveloped in its copious, sweetish pulp, in boxes closely covered, and to allow it to ferment for some days; it is then washed free of the mucilage that is still left on the surface, and after that picked and dried. A further improvement has been made upon this treatment by refraining from the washing away of the mucilage after the fermentation has taken place, and allowing it to dry upon the shell which encloses the fruit. This process is coming more generally into use, both in Trinidad and Grenada.

Cocoa requires a rich, deep, moist soil, and seems to flourish best at a low elevation. The rainfall in Trinidad averages 66 inches annually, and the finest cocoa is grown at an elevation of from 60 up to 200 feet above the sea-level; the difficulty is in finding land and climate approaching to these conditions. Judging from a few samples shown in the British Guiana Court, that country seems to afford all the conditions required. The planter finding the position and soil suitable for the enterprise, and willing to be patient until his chocolate tree has arrived at maturity, will find in the fourth year results sufficient to pay him.

The world's production of cocoa has been variously estimated at 100 to 120 million pounds, of which our English Colonies furnish quite twenty-five million, which mostly find their way to London. In Trinidad only there is a competition on the part of the United States of America and France for the inferior qualities, which are sold at the shipping port, all the finer estate cocoa being sent here.

The home consumption of Great Britain shows a steady increase of about three-quarters of a million pounds yearly, the consumption in 1885 being fourteen and a half million pounds. The English Government has taken Trinidad and Grenada cocoa for the Navy during the last seven or eight years in preference to other sorts.

The largest growing country is Ecuador, of which the produce is known in the market under the name of Guayaquil cocoa, and the extent of its crop, as well as of that of the Brazilian Province of Para, have a marked influence on the prices realised for all kinds of cocoa. Those crops vary considerably from year to year in extent, Guayaquil more especially. In our own Colonies, Trinidad shows an increase, the crop of 1885 amounting to fourteen million pounds; but in Grenada, St. Lucia, Dominica, and Jamaica, the quantity produced the last year or two does not seem to have varied. In seeking for a reason for the want of the extension of planting and cultivation to meet the increase of consumption, it may perhaps be found in the initial expense in the forming of new plantations. The trees do not yield tribute sufficiently remunerative until the fourth year. This waiting for results has no doubt prevented enterprise.

WEST INDIES.

TRINIDAD.—In this Court were exhibited forty-eight specimens, showing the production of some of the best cultivated estates in the island. Trinidad cocoa, although not considered equal in flavour to Carracas (which has the reputation of being the finest produced), has from the great attention paid to its growth, the care taken in the fermentation, and also from the natural quality of the seed, attained to great perfection. The process now generally followed in the curing seems to have developed those properties which are most valued by the manufacturers of cocoa and chocolate in this country.

Of the four samples which were of the highest value, two were acknowledged to be the finest Trinidad produces; but the other two so nearly approached them in quality and flavour that the prices realised were very nearly the same, viz., 94*s.* and 96*s.* per cwt. Following were eleven samples, the market value ranging from 86*s.* to 88*s.* It would be difficult to place them in their order of merit, on account of their near approach to equality; the general character of these fifteen samples was large size, weight and solidity of the kernel of the cocoa, combined with a perfect fermentation, carried to the point at which the fullest amount of strength and flavour can be obtained. Although the colour of the outside shell is no longer considered of value in the English market (the mucilage drying upon the surface generally a brownish-red colour), these cocoas, with few exceptions, had a bloom upon them (like the bloom of the plum), which is considered to be some indication of quality, although it is probably produced by a slight secondary fermentation in the drying.

In the second series, consisting of eighteen samples, were several of excellent quality; eight of them, ranging in value from 84*s.* to 85*s.*, were red and dark red in colour, and of fine flavour. The remaining ten, value 82*s.* and 83*s.*, were mostly reddish cocoa, but with less flavour.

In the third category were six samples of very large size and good appearance, but light in weight, and deficient in strength and flavour, value 80*s.* and 82*s.* Of the five samples left to be noticed, three were

greyish-red to red colour, of medium quality, value about 79*s.* and 80*s.*; one, overfermented, 77*s.*; and one, hard and unripe, of the same value.

The inferior sorts of cocoa, which were not represented by samples in the Trinidad Court, and form half of the growth, are, as above stated, now competed for both by France and the United States.

Although, owing to a large crop of Guayaquil last year, prices for this description have fallen during the last few months 20*s.* to 25*s.* per cwt., the two leading qualities, Michila and Ariba, selling now at 60*s.* to 75*s.* per cwt., fine Trinidad shows a reduction of 5*s.* per cwt. only. This is due to the preference shown by English manufacturers of cocoa and chocolate for the finer Trinidad growths, and by their competing for them at prices higher than Continental buyers are willing to give for them in this market.

GRENADA.—The production of cocoa in this island is the next largest in quantity to Trinidad, averaging five to six million pounds; it was scarcely represented at all in the Grenada Court, only three or four samples from one estate being shown, and I had to look to the Indian Court (the West Indian department) for seven samples representing the produce of some of the better estates.

Grenada cocoa is not equal in quality to Trinidad, being smaller in size and coarser in flavour. This year's crop has been brought to market in better condition than formerly, and a greater proportion fermented and prepared after the approved Trinidad manner (that is, fermented and unwashed), and it forms a second quality very useful to manufacturers of cocoa and chocolate. A considerable portion is cultivated by many small landowners, consequently a large quantity of it is more or less well prepared for market. No samples were shown representing this production, the market value of which, at the present time, ranges from 68*s.* to 72*s.* per cwt.

Of the four samples in the Grenada Court representing one estate, three were fairly fermented, and worth 73*s.* or 74*s.* per cwt.; the other was sound, but of poor quality, the value being about 70*s.* Of the seven samples in the Indian Court, five were of well-known estates of the best cultivation; as to quality, one sample was a bold red, value 76*s.* to 78*s.*; two others came next in quality and preparation, value 75*s.* to 76*s.*; three were reddish, with fine flavour, but a little flinty, value 73*s.* to 75*s.* The seventh sample, a greyish red, medium quality, value 70*s.* to 71*s.* Continental buyers have always taken a fair quantity for export from our market, the quality being similar to some of the foreign growths.

DOMINICA sent about thirty samples, all presenting a very good appearance, and good size in the bean. About seven were fully fermented and washed, the value from 70*s.* to 78*s.* per cwt., and fairly approaching in quality and appearance the second quality of Trinidad. Seven were unfermented, but washed, the shell of a pale red colour; these might be valued about 66*s.* The remaining samples are part fermented, and value 68*s.* to 70*s.*

The production of the island seems to be about three-quarters of a million pounds, and is steadily increasing; the bulk is of a medium quality, of better size than Grenada cocoa, but from the indifferent

manner of curing a great part of the value is lost. The exhibits were attractive in appearance, the washing and drying especially good, even of the unfermented, the cocoa being sound in condition.

ST. LUCIA.—Two samples red, partly fermented, mixed with slaty beans, value 67*s.* to 68*s.*, represented the best quality grown there. The production is about 500,000 pounds, generally sent to market washed and dried, the value at the present time being about 65*s.* Two average samples shown in the Indian Court represented the bulk of the crop, grey to greyish red in appearance; the nuts were thin and flat at the sides; the break very mixed, half being hard slate-coloured, a portion mouldy and perished, and the remainder partly fermented, showing that if cured properly the cocoa would be of fair quality and of increased value.

JAMAICA.—Of eleven samples, three were worth 67*s.* to 70*s.* per cwt.; they were fermented, and showed fair growth and curing. Three represented the unfermented, valued at 61*s.* to 62*s.*; another, a good medium quality, value 64*s.*; one described as fermented and washed, the outside appearance good, but the fruit mouldy and perished, value about 50*s.* Jamaica cocoa is of poor quality, being of very "thin" bean, and but little care seems to be taken in its preparation for the market. It has for some years been sold at prices quite 15*s.* to 20*s.* below Grenada, though lately there has been some improvement. Unless better seed can be planted, there seems little hope of any improvement taking place in the production, as the taste and flavour of the nut is now very bitter and acrid. It is apparently the most inferior of the chocolate "trees."

ST. VINCENT.—Four samples of common light red cocoa, one fermented, value 69*s.* to 70*s.*, three part fermented, value 67*s.*

TOBAGO.—One a dark red cocoa, value 68*s.*, and another red, part fermented, value 67*s.*

ANTIGUA.—A dark red sample, part fermented, value 68*s.* to 69*s.*

BARBADOS.—One red, part fermented, value 68*s.*

BRITISH GUIANA.

Ten samples, amongst the most interesting in the Exhibition, as they represented a new cultivation of the article, the small quantity grown hitherto being retained for local consumption; the seeds, it appears, were originally procured from Trinidad, and the quality, flavour, and the size were fully equal to the best from that island. Two samples, very large size, fine flavour, well picked and evenly fermented, were valued about 88*s.*; five at 82*s.* to 85*s.* were fine flavoured, but would probably bear a little fuller fermentation; one, a little imperfect in preparation, 80*s.*; the remaining sample was out of condition, value probably about 74*s.*

The excellent character of these samples shows that the soil is eminently suited for the growth of cocoa, and if the cultivation was taken up in a proper spirit, it would probably add greatly to the wealth of the Colony.

CEYLON.

The seeds were originally introduced from Trinidad in 1835; but it is only during the last six or seven years that it has been cultivated for exportation in any quantity. It is grown at a much higher elevation than in Trinidad. In the Ceylon Court the best sample was sent from an estate situated quite 1600 feet above the level of the sea. In the acclimatisation of the plant it seems to have undergone a considerable change; the first imports into London attracted great attention, the Continental buyers paying high prices on account of the peculiar bright red colour with a tinge of yellow in it. It has a very delicate fine flavour, but without the strength of the Trinidad. The process used in curing consists in fermenting, though for a shorter period than in Trinidad, then washing and drying, the Ceylon planters bestowing on these operations, as they do in everything they undertake, the most praiseworthy care and trouble. Lately trials have been made of the present Trinidad system—that is, fermenting and drying the cocoa without washing, with a view to compete with West Indian growths in the English market; but this has so far resulted in failure, the cocoa so treated having realised nearly 10*s.* per cwt. less than when prepared in the ordinary Ceylon fashion; whether this is due to inexperience in the mode of treatment, or to the Ceylon cocoa being unable through difference of climate or soil to bear the same extent of fermentation, is a question which remains to be decided by the result of further experiments. It is an undoubted fact that cocoa cured by the original process was gradually finding a more extended market in this country, English manufacturers using it as a speciality on account of its fine colour and delicate flavour.

Of the sixteen samples exhibited, six showed in the breaking up of the bean the bright high colour which is so much desired, and the value at present would average about 85*s.* per cwt. Of the remainder, there were three samples, worth 80*s.*, of bright red colour and large size, in which the process of fermentation had not been carried far enough, the original whitish colour showing still to some extent. There were three samples where the red colour was retained, but they were much too dark and dull, value 78*s.*; the unwashed sample was of a brownish-red break, the quality fair, but the value had been considerably diminished by the process used in the curing, it was worth 74*s.*; of the remaining three samples, one was of a very dark brownish break, almost black, and worm-eaten, the value about 76*s.*; the next, dark break and flinty, of the same value; the last one was the production from newly-imported seed (Forastero) from Trinidad, and was of marked difference in appearance and colour to all the others; it was of large size, the outside shell of a dull greyish colour, and the bean broke a dull brownish colour.

Of the twelve estates whence samples were exhibited, ten are situated at an elevation of 1400 to 1700 feet above the sea-level, and one estate as much as 2000 feet. This is an extraordinary high level for the growth of cocoa; but the conditions requisite for the cultivation of fine cocoa are found there, viz., fine, deep, rich soil, sufficiently moist, and a good rainfall.

Cocoa estates require, in addition, to be well sheltered from the wind; and it is doubtful whether there is enough land in Ceylon combining all those requisites for the establishment of a good cocoa plantation to justify the expectation that the culture will be extended much beyond what it is at present.

MAURITIUS.

Mauritius sent a light red sample, quality something like Ceylon in its red break, imperfectly fermented, value about 70*s.* to 72*s.*

SUGAR.*

By NEVILE LUBBOCK.

BEFORE dealing with the exhibits of sugar in the Exhibition, it may be interesting to give a short outline of the sugar industry of the world.

The sugar supply of the world is chiefly derived from the sugar cane (*Saccharum officinarum*) and the sugar beet (*Beta vulgaris*); sugar is also obtained from other vegetable sources, including the sugar maple (*Acer saccharum*), but the total quantity thus produced is relatively small.

The total quantity of sugar produced in the world so far as known is about 5,000,000 tons per annum. But this does not include the sugar produced in India, China and other tropical countries, which is consumed within those countries. As to the extent of this production no reliable information is available.

Of the known quantity of 5,000,000 tons, about one half is produced from sugar cane and one half from sugar beet. The superiority of the sugar cane over the sugar beet as a source of supply may however be fairly assumed from the following important consideration; that whereas the whole of the cane sugar in the world, with the exception of about 200,000 tons, is produced without any artificial assistance, such as protection or subsidies from Governments, there is not at the present time a single pound of beet sugar produced anywhere in the world which has not the advantage of protection in the markets of the country in which it is produced, or of export bounties in the countries which export this description of sugar. It may also be mentioned that whilst raw cane sugars, such as crystallized Demerara sugars, and the fine yellow sugars from Porto Rico and Barbados, are most agreeable to the palate, raw beet sugars of similar appearance are quite uneatable, owing to their exceedingly disagreeable flavour—a flavour which can only be got rid of by refining, or some purifying process analogous to it.

The largest consuming countries in the world, so far as any data are available, are the United States of America and the United Kingdom. The consumption of the United States for the twelve months ending October last, amounted to about 1,300,000 tons, and that of the United Kingdom for the year 1885 was estimated at 1,200,000 tons.

The sugars exhibited by our Colonies were all produced either from the sugar cane or the sugar maple, the production of sugar from the latter source being confined among our Colonies to Canada.

The following Colonies, in addition to India, exhibited samples:—Canada, New South Wales, Queensland, Natal, Fiji, Ceylon, Mauritius, Hong Kong, British Guiana, Trinidad, Barbados, Montserrat, St. Kitts, Antigua, Tobago, St. Lucia, St. Vincent, British Honduras, and Jamaica.

This list is sufficient to show how large is the area in which sugar is produced, and to prove that we need have no fear that an adequate supply of cane sugar will not at all times be forthcoming to supply the wants of

* In this Report India has been included.

the world. Moreover the qualities of sugar exhibited range from the finest sugar candy to the low brown moist description, and there is thus no lack of variety.

The total quantity of sugar produced annually by our Colonies and exported from India is about 500,000 tons. The industry is therefore an important one, and one which, in the absence of the artificial aid which its rival beet sugar obtains, is capable of almost indefinite expansion.

It being impossible within the limits of this Report to deal adequately with each individual specimen in detail, a few remarks are offered upon the general characteristics of the exhibits from each Colony; and finally a description and classification of them.

It may be desirable to explain, for the information of the uninitiated, that sugars may be divided into two categories.

1. Pure crystallized cane sugar.
2. Impure sugars.

It may be further explained that pure crystallized cane sugar is perfectly white, and may be the product of the sugar cane, the sugar beet, the sugar maple or many other vegetable substances. Pure cane sugar, or as it is sometimes called *sucrose*, is a well defined substance whose chemical composition is invariable, and whose chemical formula is $C_{12}H_{22}O_{11}$. Impure sugars are usually a mixture of this substance with other matter, which generally consists of a small quantity of inverted sugar, or *glucose*, whose chemical formula is $C_{12}H_{24}O_{12}$, water, and a small quantity of certain salts generally described in analyses as *ash*, and in the case of very inferior sugars, certain other organic matter which may be generically described as *dirt*. This explanation will enable the reader to understand the typical analyses which follow the description of the exhibits. For the sake of comparison, India has been included.

INDIA.

Approximate annual export: 50,000 tons.

The samples exhibited, seven in all, were of a high class, but quite unsuited for this market. The loaf sugar, although by analysis but little inferior to the loaf sugar manufactured in this country, is entirely lacking in brilliancy, and has also the appearance to an uneducated eye of being far more inferior to the loaf to which we are accustomed than it is in reality. The British public attaches more importance to the appearance of sugar than to its intrinsic value. Hence the sugars most suitable to the English market are those which are most attractive in appearance. The same remarks apply to the white and grey granulated. The bulk of the sugar produced in India, and of that which comes from India to this country, is commonly known by the name of jaggery, but this description of sugar was not represented by any specimens.

CANADA.

Extent of production unknown.

Canada sent some excellent samples of refined sugar, both loaf and granulated, made from imported sugars. She also exhibited specimens of the well-known maple sugar. This sugar cannot apparently be produced at a price approaching cane sugar; but it has an agreeable flavour, and hence there is a certain demand for it, rather in the nature of a sweetmeat than as sugar.

Maple syrup is also a very popular article of food in America and Canada; but the industry appears to be almost outside of what may be properly called the sugar industry.

NEW SOUTH WALES.

Approximate annual production: 17,500 tons.

The exhibits from this Colony consisted of white cubes, crystals, granulated, grey crystals, semi-grainy, and the ordinary brown second runnings. These sugars, although of a high class, are not, as already explained, a profitable description of sugar to make for this market. They are no doubt suited for the local consumption. They rarely find their way to this country, and probably look entirely to Australia for a market.

QUEENSLAND.

Approximate annual production: 55,900 tons.

The sugars exhibited in this section were principally white crystals and white moist. The sugars, with the exception of some specimens of average yellow crystals, are unsuited to the English market, for the reason explained in the case of the Indian exhibits.

NATAL.

Approximate annual production: 16,000 tons.

There was a great variety of specimens from this Colony, but none were of a very attractive appearance. It would be well worth the while of the Natal sugar manufacturers to endeavour to improve their sugars in this respect. From the appearance of the sugars, proper attention is apparently not given to the clarification of the juice before evaporation. There were two samples of brown concrete which were very suitable for refining. The higher grades of crystallized sugar were such as would be described in the London market as very grey, and would only be used by refiners. Sugars of the same analysis, but of a bright yellow colour, would be worth fully £2 per ton more than the samples shown.

FIJI.

Approximate annual production: 12,000 tons.

The samples exhibited from this Colony were of a very superior quality; the white crushed being almost bright, and the yellow crystals of large grain, far too large however for the English market. Fiji probably looks more to Australia than to Great Britain for her market, and has no doubt adapted her makes to the taste of the Australians. The sugars had a clean healthy appearance, and would appear to indicate a good quality of cane juice and careful manufacture.

CEYLON.

Approximate annual production: 350 tons.

Ceylon sent but a poor show. A few samples of small-grained dirtyish white sugar apparently produced by considerable washing, a very extravagant method of improving quality; also a few cakes of concrete. These had been put into small matted baskets, holding about ¼ lb. They must therefore either have been specially made for a sample or for some local demand, as in this form they would not be suitable as an article of commerce. They had the appearance of having been made for sale as sweetmeats.

MAURITIUS.

Approximate annual production: 120,000 tons.

Mauritius sent one specimen of loaf sugar of good quality; but, like the loaf sugars of all the Colonies, far inferior in appearance to our English make. The other samples were chiefly white crystals, not very bright, second runnings; and a peculiar large yellow crystal, quite unknown in this market and specially made for the brewers' use in the East. It is certainly curious and remarkable that this description of sugar should be specially made for the use of brewers, for whom, except in respect of its cleanliness, it is eminently unsuitable. Before sugar is available for the purpose of producing the alcohol required for beer, it must be inverted, and it would therefore seem more natural to use inverted sugar, which can be produced from the lowest descriptions of raw sugar and rendered perfectly clean by the use of charcoal, rather than to use the highest class of crystallized sugar to be inverted subsequently during the process of fermentation.

HONG KONG.

The sugars exhibited from Hong Kong, unlike those from our other Colonies, were *refined* sugars: that is, they were made from imported sugars

which had been redissolved, not directly from the cane juice. They comprised all the qualities usually turned out by refiners, from sugar candy to low pieces. They were very creditable to the China Sugar Refining Co., although they did not come up to the best makes of this country.

WEST INDIES AND BRITISH GUIANA.

Approximate annual production: 280,000 tons.

The sugars exhibited by these Colonies were various, and included the brown muscovado, so much liked by our refiners and those of the United States; fine yellow muscovado suited for grocery purposes, which chiefly comes from Barbados; the well-known bright yellow crystallized, mostly from Demerara, but now also largely produced in Trinidad, Barbados and some of the other islands; and finally white crystals. These sugars are all eminently suitable for the English market, except the white crystals, which cannot compete with those of our refiners, not on account of any real inferiority, but from the impossibility of producing, at a cost which would be profitable, that sparkling appearance which our refiners working on a large scale can produce at a merely trifling expense.

I am much indebted to Mr. W. E. Halse, the well-known analytical chemist of Mark Lane, for the assistance he has afforded me in drawing up this Report, and for the typical analyses which accompany it. I am also indebted to Mr. John McCarthy, the Government Chemist of Trinidad, for his assistance in collecting and arranging the numerous samples which had to be examined and classified.

CLASSIFICATION OF EXHIBITS.

No. of Samples.	Description.	No. of Samples.	Description.
	INDIA.		QUEENSLAND.
1	Loaf sugar.	47	White and greyish-white crystals.
5	White crystals, bright.	8	Low grey crystallized and semi-grainy.
1	Low grey crystals.	14	Molasses sugar, brown to coloury.
	CANADA.		NATAL.
1	Loaf.	4	Dull greyish white.
3	Granulated white.	12	Very grey grainy.
2	Maple.	4	Fair grey-brown syrups.
	NEW SOUTH WALES.	2	Fryer's concrete.
1	White cubes.		FIJI.
11	White crystals.	3	White crystals.
2	Semi-grainy.		
7	Brown syrups.		

CLASSIFICATION OF EXHIBITS—*continued.*

No. of Samples.	Description.
	CEYLON.
1	White crystals.
2	White, small-grained.
2	Molasses and syrups.
3	Concrete, brown.
	MAURITIUS.
1	Loaf.
33	Greyish to fair white grainy and crystallized.
5	Large brewers' crystals.
7	Molasses sugar, fine grey to very low dark.
1	Concrete.
	HONG KONG.
	Refined sugars—
1	White sugar candy.
2	Loaf.
5	White grainy and crystallized.
4	Yellow pieces.
	BRITISH GUIANA.
15	Crystallized, pale yellow to white.
21	,, good to fine yellow.
18	,, low to good yellow.
9	,, grey refining.
10	Molasses sugar, low dark brown to fine yellow.
	TRINIDAD.
7	Crystallized, yellowish white to white.
11	Crystallized, yellow grocery.
5	,, grey refining.
7	Molasses sugar, fair brown.
	BARBADOS.
4	Crystallized, yellowish white to white.
12	Crystallized, yellow.
2	Muscovado, Dutch, No. 11.
10	,, ,, ,, 12.
9	,, ,, ,, 13.
2	,, ,, ,, 14.
1	,, ,, ,, 15.
	MONTSERRAT.
1	Muscovado, Dutch, No. 8.
2	,, ,, ,, 9.

No. of Samples.	Description.
	ST. KITTS.
1	Crystallized, white.
2	,, fair yellow.
1	Muscovado, Dutch, No. 10.
	ANTIGUA.
4	Muscovado, Dutch, No. 10.
10	,, ,, ,, 11.
6	,, ,, ,, 12.
	TOBAGO.
1	Muscovado, Dutch, No. 7.
3	,, ,, ,, 10.
4	,, ,, ,, 11.
2	,, ,, ,, 12.
1	,, ,, ,, 14.
	ST. LUCIA.
1	Crystallized, white soft dirtyish small grained.
7	Crystallized, yellowish white to white.
1	Crystallized, medium yellow.
	ST. VINCENT.
2	Low yellow grainy.
4	Muscovado, Dutch, No. 9.
7	,, ,, ,, 11.
7	,, ,, ,, 12.
	DOMINICA.
1	Muscovado, Dutch, No. 8½.
1	,, ,, ,, 11.
3	,, ,, ,, 12.
	BRITISH HONDURAS.
1	Muscovado, Dutch, No. 9.
2	,, ,, ,, 11.
2	,, ,, ,, 12.
1	,, ,, ,, 13.
1	Concrete, good brown.
	JAMAICA.
3	Crystallized, dull grainy white.
4	,, greyish yellow.
1	Muscovado, Dutch, No. 9.
2	,, ,, ,, 11.
2	,, ,, ,, 12.
3	,, ,, ,, 13.
3	,, ,, ,, 14.

NOTE.—In consequence of the length of time the samples have been here many of them have dried up to a certain extent, and in the case of the more coloury samples they have been more or less affected in appearance by London smoke.

of the interest which its importance should command. There will consequently be an effort made to classify the different kinds of exhibits under the respective heads of—

1. Wines (as being most important).
2. Spirits, made from sugar and other materials.
3. Malt liquors and the somewhat similar fermented beverages.

The classification will be far from perfect, because some exhibits, such as vermouth, belong strictly to neither class. It will, however, be attempted to make the divisions as sharp as practicable, and as strict as the materials themselves will allow.

Nature has rendered very valuable help in making this classification, because, broadly, she has defined in what latitudes plants and cereals shall grow, and has taught us that it is useless for us to endeavour to make tropical plants flourish successfully in temperate climates, or the reverse. She has therefore settled for us which of our Colonies can be wine-producing, by confining the perfect growth of the vine within certain latitudes, and has brought within still narrower limits those districts in which soil, climate, and particular adaptation lend themselves to the culture of the vine, so as to produce grapes of sufficient quantity and quality which will with proper care yield good commercial wine. The qualities and characters of commercial wines are very various, and from the delicate hock of the Rhine to the luscious wines of Greece there are so many gradations that it is not difficult to produce a wine falling between them. But as it is not only necessary in business to produce a wine that may be appreciated by the few, but to make viticulture a paying concern, the wine made must be appreciated by the many, and the aim of those acquainted with their business is to cater for the public taste, and thus endeavour to supply a public want. Any other aim than this can only be indulged in by a waste of capital which will not only not pay, but will tend to bring the industry itself into contempt. The climatic and other conditions enumerated confine the production of wine to the Australian Colonies, New Zealand, the Cape of Good Hope, Cyprus, and certain districts in the Dominion of Canada.

The growth of cereals, such as barley and rye, can be carried on with greatest success in colder latitudes, consequently the production of malt liquors made from barley, or of spirits from barley or rye, or from a mixture of both, can be carried on over a more extended area than that available for the manufacture of Colonial wines; and some Colonies, such as Canada and New Zealand, which produce but little wine, are largely engaged in the manufacture of beer and spirits.

A visit to the Courts of the tropical or sub-tropical Colonies showed from the rich displays of sugar and the sugar-cane, and the absence of wine and all spirits, except that made from sugar and popularly designated as rum, that wine and malt liquors cannot be produced successfully in the tropics; but such a visit also revealed the fact that even there the people are very practical, as they turn their attention to the manufacture of spirituous liquids which are intended as much for medicines as beverages, and whose composition shows that they are intended for the cure of febrile disorders, a class of disease very prevalent in tropical regions.

As alcohol in its varied forms can be obtained by fermentation from grapes, cereals, sugar, cocoa-nut juice, &c., the area of its production extends to all our Colonies, and it will be seen from the samples of alcohol

mentioned that specimens were sent from almost the whole of them, although some of the descriptions of spirits represented have only a local reputation.

1. Wines.

A careful study of the names of the wines exhibited—which will again be referred to—may occasion some surprise that names are found like the wines in common use in European countries, but in many instances the character of the wine scarcely agrees with that of the European wine of the same name, although there may be some points of resemblance. The area of land in Australia, for instance, which by soil and climate is capable of producing good wine, is large enough to grow sufficient for world-wide consumption, and the different elevations of the land furnish districts which for temperature will agree with the different districts of Europe which produce distinctive wines. Up to the present time, however, the kinds of grapes grown on such lands have not always been suitable for producing the exact description of wine required; and therefore in such cases the wine has not possessed the character, flavour, and bouquet sought for. Moreover, the first great question to be settled in connection with the nomenclature of wines is, whether it should be the aim of the colonists to produce wines of the same name as wines of European growth, or to manufacture wines which, though as delicate and distinctive in character as the wines now produced in France, Spain, Germany, and other European countries, should have specific names of their own, and thus on their own merits alone should make a bid for popular favour. In this country some of the most successful wine merchants have attained notoriety and wealth by selling wines of their own brand, and it is probable that when our Colonial wine-growers have devoted more attention to this subject (which has been brought prominently before them by their representatives now in this country), they also will arrive at the conclusion that distinctive names of their own will be more helpful to their success than the conventional names of port, sherry, and similar class names of the wines of European production.

The Australian Colonies which sent wines to the Exhibition of 1862 and to the Health Exhibition of 1884, and obtained medals for their exhibits, deserve first attention as wine-producing countries on account of the large quantity of wine exhibited, and also because of the large amount of capital invested in certain of those Colonies in grape culture.

New South Wales, which is the mother Colony of Australia, is said to possess "districts of sufficient area, and combining the necessary conditions of soil, climate, and aspect to produce wine enough to supply the whole of the world." Whether this statement be true or not, it is not necessary to stop to inquire; but the vine, which is not indigenous, is said to have been first introduced in any quantity into this Colony by Mr. John Macarthur in 1820,* and Mr. Busby in 1831 having visited Europe,

* There is evidence that the first importation of wine into this country from Australia was in 1822. In 1823 a silver medal was awarded by the Society of Arts to Mr. Gregory Blaxland for a quarter of a pipe of red wine resembling claret. In 1828 a gold medal was awarded to the same gentleman for a superior quality of the same wine. Some official papers sent to the Society by Mr. Blaxland show that he was engaged in the cultivation of the vine in 1816, four years before the date above given.—*Transactions of Society of Arts*, vol. xli. p. 285; vol. xlvi. p. 133.—[Ed.]

took back with him a very valuable collection of young vines from France and the Rhine. The action of Mr. Busby was a most enlightened and far-reaching one. The colonists, who consisted mostly of English, Scotch, and Irish settlers, knew from previous experience that the vine would flourish in Australia, but knowing nothing of wine-making they had considered their purpose served when vines were planted, little thinking that the character of the grape influenced the flavour, bouquet, and general character of the wine. Before Mr. Busby's day any vines that came to hand were cultivated and flourished, and for many years viticulture was not reduced to a system, nothing being known of what was necessary to produce wine of good commercial quality. Grape cultivation and wine-making have, however, made rapid progress in New South Wales, and the same remark applies to Victoria and South Australia. In the first-named Colony the quantity of land under vine cultivation in 1883 was 4378 acres, the quantity of wine produced was 589,604 gallons, brandy 4162 gallons, and of grapes for the table the quantity picked was 1378 tons. In Victoria the vineyards cover 10,000 acres, and in 1884–5 they yielded 760,752 gallons of wine. In South Australia in 1884 the vineyards covered 4590 acres, and produced 473,535 gallons of wine, and for the year 1885 the yield had risen to 600,000 gallons.

In these three Colonies much capital and intelligence have been invested in viticulture, as the above figures and the progress made will show. Fortunately each Colony possesses excellent vineyards, and the healthy and good-natured rivalry brought into existence by the desire of one capitalist to excel another has done much to develop the wine-growing industry, and to produce wines which have characteristic qualities sufficiently pronounced to cause them to find favour in foreign markets. Adversity has also had much to do with this success. About twenty years ago, when the fashion was for strong wines, such as port and sherry, which wines also were those best known to and appreciated by the colonists, an incentive was given to wine cultivation by the offer of land supposed to be suitable for wine-growing, on very favourable terms, and other means were used to incite people to embark in vine-planting. Companies were formed for working vineyards, and many private persons possessed of no special knowledge of the subject, but who had money without the wisdom to use it, became vineyard proprietors. The localities selected for the vineyards were in warm districts, so that the products of the vineyards should be of the port and sherry class of wines. But unfortunately for the success of these undertakings fashion had changed in favour of light wines, and thus the wine, even if it had been good, could not have been sold. But the wine was not good. Through improper manipulation of the grapes and defective fermentation the wine soon became sour and unfit for consumption as wine. Mixing with lighter wines only imparted unsoundness to the mixture, and thus through a failure that might have been foreseen, viticulture was discredited, and numerous vineyards were either stocked up or allowed to run to waste. The unhealthy extension of viticulture as above described was not, unfortunately, confined to one Colony; all of them suffered from the same cause. In South Australia in 1866 the quantity of land under vine cultivation reached 6629 acres, and the number of gallons of wine made in 1870 was 895,000 gallons. But the mistake that had been made brought all the Australian wines into

disfavour, the production rapidly overtook the demand, the inexperienced growers who had rushed into vine-planting without knowledge lost money, and at the same time lost heart, vineyards were either stocked up or abandoned, till in 1881 the production of wine in this Colony had fallen to 313,000 gallons. It is said that the darkest part of the night is just before the dawn, and this remark applies with great force to the progress of vine culture. When the rush was made to extend vineyards for producing heavy wines, a few cultivators, possessing intelligence, taste, and discrimination, had gathered from the trade journals and other sources that light wines were to a large extent taking the place in European markets of the heavier descriptions, and that sherry, port, madeira, and similar wines were growing out of favour.

These men selected sites for vineyards in high latitudes where the temperature corresponded more closely with that which generally prevails in those parts of France and Germany where claret, sauterne, burgundy, and hock are produced. Vines were planted which in Europe produced the wines named, every attention was paid to the tilling and tending of the vineyard, the grapes were harvested with the greatest care, then pressed in the most approved manner, and the fermentation conducted on scientific principles. The result was that wine of low alcoholic strength was produced, its flavour, character, and bouquet were appreciated, and though not actually praised, it was not condemned. At this juncture, when the wine referred to was ripening, exhibitions were held at Melbourne and Adelaide in 1881. The most successful growers in each Colony sent specimens of their wines for exhibition, and at each place there was a good display.

At Melbourne, a grand prize valued at £800 was offered by the Emperor of Germany to be awarded "to an exhibitor in one of the Australian Colonies, as an acknowledgment of the effort in promoting art and industry as shown by the high qualities of the goods manufactured by such exhibitor;" and at Adelaide, a prize consisting of a handsome piece of plate was offered by the Mayor of Adelaide "to the exhibitor who shall by his exhibit show that he has done most to promote an industry or industries of national importance and likely to be a source of wealth to the Australian Colonies."

To the surprise of many, the Emperor of Germany's prize was awarded to Messrs. De Castella and Rowan, St. Hubert's Vineyard, Victoria; and the Mayor of Adelaide's prize to Mr. Thomas Hardy, Bankside Vineyard, near Adelaide, "in recognition of successful individual enterprise of much magnitude in various industries as illustrated by his exhibit."

This double recognition of the progress made and success attained in viticulture, and the fact that one of the prizes had been given by the Emperor of Germany, excited the interest of persons living at a distance, and caused some of them to taste the wines from motives of either interest or curiosity; and at home those wine-growers who had commenced to produce light wine were encouraged to persevere, whilst those who had continued to manufacture heavy improper fermented sorts were induced to work on different lines, and wine dealers who had avoided home-grown wines were tempted to keep the prize types of wine in stock, and thus the wines of native growth once more became popular. Persons who had never before kept any but foreign wine in their cellars were induced to keep native wine, and familiarity with its qualities proved that it might with

advantage take the place of wine imported from Europe. The impetus thus given to the wine industry has steadily increased up to the present time. Many of the vineyards which in the dark days referred to were thrown out of cultivation were bought at a low price. Their new owners were most particular in their methods of cultivation, in the planting of the best descriptions of grapes, and in the manner of conducting the vintage and maturing the wine. The improvements made were either purchased by dear experience from the failures of the past, or learnt from acquaintance with European vineyards, and the different methods in force there for producing the many descriptions of wine which were popular in the European markets. Above all, attention was directed to the composition of the soil suitable for the growth of the different descriptions of vine, and it was seen that the ordinary soil was too rich, and that soil which had been exhausted by a succession of wheat or other cereal crops was best adapted for planting as a vineyard.

The indomitable perseverance and dogged determination to succeed possessed by the colonists have resulted in the progress which has during the last four or five years been made by leaps and bounds in viticulture, and many of them have during that period been exhibitors at different foreign exhibitions. At Bordeaux, the home of the French wine industry, no less than seventy Australian wine-growers were exhibitors in 1882, and to some of the wines medals were awarded. It was natural that in an old vinicole country like France astonishment should be expressed at the boldness of such youthful vine-growing countries entering their wines for competition, and suggestions were made that they should look to other than European markets for the disposal of their wine. But having the proper soil and grapes, there will be little difficulty in properly manipulating the wines, and especially so as some proprietors, as before stated, are either making themselves acquainted by personal observation with the successful management of wine when maturing in the cellars as practised in Europe, or are importing skilled labour from thence. And this progress is marked by the steady increase in the quantity of wine imported into Europe from Australia, which wine when known and properly appreciated will become popular on account of its fitness for consumption in a cold climate like ours.

Moreover, other causes have arisen to lend a helping hand to the consumption of Australian wines. Since 1869 the *Phylloxera Vastatrix* has extended its ravages in the vineyards of Europe, till in some parts of France, where flooding of the vineyards cannot be practised on account of their high position on the hills, whole districts are passing out of vine cultivation. The devastation wrought by this pest has been so great that the Government has offered large money prizes to the discoverer of an effectual remedy for the disease. Although with the emergency many workers have entered the field, and have thus become acquainted with the life history of the insect causing the mischief, yet no remedy suggested has been sufficiently effectual to warrant the Government to award the prize. There is little doubt but that the only successful way of meeting the difficulty will be to stamp out the disease by grubbing up the affected vines, burning them, and letting the ground rest from vine-growing for a time. This method, however, presents so many difficulties in the way of its successful application, that it is doubtful whether it will ever be tried in old

vine-growing countries with peasant proprietors. In the meantime the dead vines are allowed to decay in the ground, and thus they become breeding grounds for the *phylloxera* so long as the decaying plants can yield any nourishment. The cost of compensating the vignerons, if they were forcibly compelled to destroy diseased vineyards, would be so great that it is likely the industry will be permitted to be seriously crippled rather than the effectual remedy suggested be put into practice. *Phylloxera* disease has broken out in Australia also, but the vineyards being comparatively few in number and mostly in the hands of capitalists, stringent and even drastic measures were immediately taken to root out the evil. The affected vineyard was at once destroyed, the vines were carefully rooted up and burned, a cordon was drawn round the affected district, and even now no vine is permitted to be planted within it. The following details may, however, be of interest, as showing the exact course taken in the matter.

In Victoria, where the *phylloxera* was first discovered, the Government at once appointed inspectors of vineyards, with power to enter any land where vines were growing to discover infected vines. When found the duty of the inspectors was to inform the Chief Secretary, who might authorise steps to be taken to eradicate the disease by destroying the vines or in any other way, no compensation being granted to the owner of the vines for any loss sustained in consequence of such measures. In November, 1880, a Select Committee of the Legislative Assembly was appointed to inquire into the state of the disease, and the best means of eradicating or mitigating it. On the report of this Select Committee another Act was passed repealing all other Acts on the subject of vine-disease, and providing for the proclamation of infected localities as "vine-disease districts," to which inspectors should be appointed. The Minister was given powers under the Act to have uprooted all the vines, whether diseased or not, within a radius of three miles of the affected spot, compensation being given to the owners of diseased vines up to the value of one year's crop, and to owners of vines not diseased up to the value of three years' crops. Persons were prohibited under a penalty not exceeding £100, or imprisonment for any term not exceeding six months, from removing from a "vine-disease district" any vine or part of a vine. The Governor in Council was also granted power to restrict the importation of vines, vine cuttings, or grapes, and to make proper regulations for carrying the Act into effect. In December, 1880, the subject of vine-disease was brought under notice at the Intercolonial Conference held in Melbourne, and it was agreed by the Colonies of New South Wales, South Australia, and Victoria to contribute jointly to the expense of eradicating the disease. These regulations are still in force, and though they have been acted on with the greatest rigour, yet the *phylloxera* is not yet extinct. Recent examinations have shown that it still lives in several of the infected properties upon the succulent rootlets which have been left in the ground. Upon the thoroughly-decayed roots the insects are dead from want of nourishment; and as the area of succulent roots is yearly becoming less, there is reason to expect that the pest will be eventually eradicated.

It will thus be seen that the intention to progress in vine-growing is shared in by the Governments of the respective Colonies, as well as by the viticulturists themselves, and the determination to succeed is well illustrated

by the sacrifices those engaged in the trade are ready to make for the common good. In addition to the *phylloxera* the French vineyards are visited with another terrible pest, the fungus *oidium*. In the year 1845 it was first discovered, and named *Oidium Tuckeri* in honour of Tucker, its discoverer. In 1851 it made its appearance in the department of the Gironde, and since that time it has spread over the greater part of the Bordeaux district. It shows itself particularly when the nights are damp and the days hot, and from the first year of its appearance it has till now been an annual visitor. The most effectual remedy against the disease has proved to be powdered sulphur, and the application of the sulphur (*soufrage*) to the plants is an operation performed more or less frequently, according to whether the season is wet or dry. The Australian vignerons, though also troubled with the fungus, have it more effectually under control on account of the greater certainty of the weather; they have consequently little difficulty in growing sound healthy plants, in maturing the grapes without mould, and thus securing the grape harvest in perfect condition. Fermentation will therefore be healthy, and the wines, if properly treated in the cellars, develop their qualities without deterioration from the presence of disease, ferments, or other hurtful matters.

The ravages caused in the French vineyards by the *phylloxera* and *oidium* have produced a dearth in the yield of wine of keeping quality, and it has been necessary for the Bordeaux shippers to draw supplies of stout wines for mixing purposes from Spain, Italy, and other countries. These mixed wines, which have been shipped to Great Britain and other countries as clarets, have not the clean flavour of genuine claret, and have the property, if kept for any length of time in bottle, of depositing a crust almost as stout as that of port. This modified flavoured claret has tended to accustom claret drinkers to the fuller flavour possessed by Australian wines of the claret type, which flavour has been produced by the richer grapes which have yielded the wine; and the demand for these fuller wines, which, as before stated, suit our climate, has been heightened by their sale at the different refreshment bars of the Exhibition, and by dealers throughout the country, whose customers are buying the wine on its own merits and in considerable quantities.

Before passing from the Australian and New Zealand Exhibits, it may be necessary to say a few words on the nomenclature of the wines. This nomenclature will on examination be found to be a mixed one. Some exhibitors have used the names of the wines in general consumption in Europe. Others, again, have used many of these names coupled with the name of the vineyard where the wine was produced, and another class having carefully noted that the wines, even when obtained from particular grapes, have a character which gives them distinctness, have therefore named the wine after the grape from which it was made. In this last class will be observed such names as Malbec, Shiraz, Carbinet, Verdeilho, Pineau, Salvino, Pedro-Ximenes, Reisling, Chasselas, and the like.

The key to these names, as describing a particular class of wine, is that the vines producing the wines have such distinctive names. Thus the vines most in demand in the claret district round Bordeaux are the Cabernet, with its varieties of the Cabernet Sauvignon, Gros Cabernet and Carmenere, the Merlot, the Malbec, and the Verdot. The vines for producing white wine in the same district are the Semillon, the Sauvignon,

and the Muscadelli. In Burgundy, there is the Pineau; in Switzerland, the Chasselas; in the Rhine district, the Reisling; in Hungary, the Tokay; in Spain, the Verdeilho, the Albillo, the Grenache, and the Pedro-Ximenes; in Madeira, the Verdeilho and Vidogna; in Portugal, the Mourisco and Bastardo; in the Champagne district, the Pineau as in Burgundy; and in the Hermitage district, the Roussane and the Syra.

It will be seen from the full descriptions of the wines given in the list of exhibits that many specimens are produced from mixed grapes, and in such cases the wines are rather nondescript in character, possessing a flavour and bouquet specially their own.

Of the comparative merits of the wines themselves, and of the different exhibits, I assume that it would be undesirable for me to treat in detail in this report. In the exhibits were to be found good representative specimens of the many different kinds of wine in general demand in this country. Most of them, which are classed as light wines, contain more spirit than those of a similar description produced in Europe. This comparative richness in alcohol is not, however, caused by the addition of spirit, but has been produced in the wine by natural fermentation. These light wines will be found very suitable as beverages during cold weather, and will, except in the hottest summer months, be appreciated as dinner wines.

Other specimens—and these include a very large number of the samples of wine exhibited—possess distinctive specialities of flavour, fulness, and bouquet. They are in most instances designated by special names, and possessing, as they do, many valuable properties, it is not a sanguine expectation that many of them will become familiar to the wine-drinking community of this conntry, and in time be as well known as the older sorts of port, sherry, &c., which from changes of fashion, or other causes, are apparently passing out of favour.

The exhibits of wine from Western Australia, Queensland, and New Zealand were few in number. The climate of Queensland is in many parts sub-tropical, and consequently too hot for the successful growth of the vine. Western Australia, being very thinly populated, cannot be expected to make such a show in wine production as her three comparatively wealthy sisters, but some of the wines exhibited are pleasant beverages, and would no doubt, if produced in sufficient quantity at a reasonable price, command a fair sale at the place of production. New Zealand, from her exhibits, appears to adapt herself with success to other pursuits than viticulture, and therefore follows those occupations for which the climate is more particularly fitted.

The Cape of Good Hope exhibits are the next that demand attention, but the wine industry in that Colony is not in such a flourishing condition as it ought to be, although from causes to be referred to presently it is improving. Viticulture is an old-established branch of industry, having commenced about the year 1653. Its progress was stimulated in 1687 by the arrival of some Protestant refugees, driven from France on the revocation of the edict of Nantes, to whom a home was offered at the Cape by the Dutch East India Company. These men understood vine cultivation and turned their attention to it. In the year referred to it is said that 500,000 vines were under cultivation, in 1880 the number had increased to sixty millions, and in 1885 to seventy millions.

Through climatic conditions the vineyards are mostly found in the western provinces, where the blending of heat and moisture is so perfect

that it is said the production of wine from the same number of vines is about nine times more than in France, and four times in excess of the yield in the most favoured of other wine-producing countries. No objection can be made to the quantity or quality of the juice, but the wine made from it has generally suffered from careless or unskilful treatment during the process of manufacture. Good wine has been produced, hence there is reason to hope that the efforts now made to improve the quality will be crowned with success. The Government two years ago appointed a viticultural expert to raise the quality of the wine made in the Colony, and to introduce the best methods of wine-making. An experimental vineyard of repute has since been purchased as a training ground, the most modern appliances are used, and a number of young farmers receive instruction in all the different branches of viticulture. With such an expenditure of money, and under the most favourable climatic conditions, it is only reasonable to expect that Cape wines will in the near future occupy a prominent position in the European markets on account of their quality, and that the brandy will do so likewise. For some twenty years it has been a decaying industry, as will be seen from the fact that in 1865 the quantity of wine exported was 195,000 gallons, while in 1885 the quantity sent out of the country was only 92,000 gallons. A pleasing and satisfactory exception to this marked decline has been in the case of the wine known here as Constantia, and which possesses many attractive qualities. The quantity exported in 1885 was four times greater than in 1865.

The different descriptions of grape grown in the vineyards afford a good illustration of the changes that take place in the quality and character of the wine produced from vines when grown and cultivated in foreign soil and in a different climate. Thus there is not one of the older imported vines which produces grapes similar in size, character, or flavour to the old stock from which it was taken. Of the vines now in cultivation the most common is what is called the Green grape; it possesses qualities which cause it to withstand the attacks of insects and fungoid growths. The Haanepot grape possesses a strong bouquet, but it is delicate with regard to soil, *oidium*, and rust. The Stein grape is not so common as the two before mentioned, but it yields well, and produces a wine possessing much delicacy of flavour.

The Muscatel grape of the red variety produces a red wine, which improves much by age. The white variety is naturalized, but not much grown.

Of dark grapes the Pontac is considered most valuable; the wine it yields is dark in colour, of good quality and flavour, and with proper treatment bids fair to be an excellent wine.

The sweet Frontignac grape yields the well-known wine Constantia.

The Cape wines are not called by European names, and as they possess specific characteristics making their identification easy, it is wise policy to make them candidates for public favour on their own merits.

Of the wine exhibits, none perhaps were more interesting than those from Canada. Till within a very recent period vine cultivation has been neglected, but as it is said that Nature has marked out the country for the home of the grape, it must be evident that viticulture has hitherto not had the attention it deserves. The European varieties of the vine do not flourish, and it has been necessary to make the two indigenous vines, the Fox and Forest, the starting-points for the introduction of others. These two

descriptions have either been crossed with each other or with European varieties. According to the census of 1881, there were raised in the Dominion the previous year, nearly 4,000,000 lbs. of grapes, of which 3,700,000 lbs. were grown in the Province of Ontario. Since that time considerable progress has been made with the growth of the vine on a larger area of land, and from past experience of the progress made, even under somewhat unfavourable conditions of climate, it is only reasonable to expect that, with the extended vine area, wine-making will be developed, and that the judgment and skill of those engaged in this new industry will result in producing wines possessing more than a local reputation.

The wines exhibited are called by the conventional names of port, sherry, claret, &c., but they have little in common with the wines of the same name sold here. They are, however, sound well-flavoured beverages, and each wine has a distinctive character.

Viticulture in Cyprus has been an industry from very ancient times, in fact its origin is lost in antiquity. The climate and soil are both favourable to grape cultivation, but the manufactured wine has not been so popular as the richness and flavour of the grapes producing it ought to make it. The method of manufacture is, however, to a great extent responsible for this. Until very recently the fermentation of the grape juice took place in jars, and to make them more durable they were besmeared with tar. The wine thus contracted a tar-flavour, which to most persons was very objectionable. With more knowledge, and the introduction into the island of foreign capital, the wine, as well as other cognate industries, is improving, and the vintage and subsequent treatment of the grapes are carried out more in accordance with modern methods of wine production. Casks have now taken the place of jars, and the improvement in the condition of the wine is proved by the increase in the quantity exported. In 1884 the quantity sent away was 1,500,000 gallons, two-thirds of which went to Egypt and Turkey. The wines produced in the island are generally of fuller body and flavour than those which command a large sale in this country, but they can be made more delicate by pressing the grapes when ripe, and not allowing them to hang till they are shrivelled, and consequently very rich in saccharine matter. They lend themselves readily for blending with weak wines grown in colder climates, which would not keep unless blended or fortified.

The common black ordinary wine of the island has the astringency of port with the characteristic flavour of a full French wine, and it is so cheap that it could be sold in England at seven or eight shillings per dozen quarts.

2. Spirits, &c.

Of the spirits exhibited the principal collections were from those Colonies situated in the region where the sugar-cane flourishes, and where it can be as successfully cultivated as the present depressed condition of the sugar market will allow. The West India Islands and Guiana, which yield neither wine nor beer, had very varied and excellent collections of rum and other products containing spirit, which are used either as beverages or medicines. The most extensive collection of rum exhibits was from the island of Jamaica. Rum from this island has a well-known distinctive character, but why the sugar spirit made here should differ in quality and character from that made from the same material in adjoining islands is a

question which has remained up to the present time without an answer. It has been stated that the rum distiller in Jamaica uses in his subsequent fermenting and distilling operations, a portion of the lees or extractive matter of the previous operation, and thus secures for his product a special character which develops by keeping. But whether this be so or not, it is certain that all the rum distillers, including those of Jamaica, work in a very extravagant manner by permitting the molasses when diluted to spontaneously ferment instead of adding yeast to promote fermentation. It is computed that about 40 per cent. of the sugar used is lost in the process, through its conversion into other bodies than alcohol and carbonic acid, during the prolonged fermentation. The fact is not overlooked that the yeast would have to be imported and kept sound till required for use, but the gain would be great to the distiller if this method were adopted. Perhaps the depressed condition of the trade may conduce to the introduction of more profitable methods of working, and to the abandonment or modification of the present extravagant way of making rum.

British Guiana supplied forty-five exhibits of rum of varied colour and character. The export trade in rum is very considerable, the quantity in 1885 having reached 28,353 puncheons, nearly 24,000 of which were sent to Great Britain.

Trinidad exhibited twelve samples only, but, fortunately for the prosperity of this island, other industries beside that of sugar-growing are carried on, and that too at a considerable profit.

Many of the West India Islands, in addition to Guiana, Mauritius, Tobago and Honduras, exhibited specialities containing spirit which, being partly beverages and partly medicines, have in some cases more than a local reputation. Most of them contain greater or lesser quantities of the extract of cinchona bark, and these preparations have no doubt been made of this composition to supply a public want, mainly as a remedy for febrile disorders. In the French Colonies adjacent, the manufacture of such hybrid mixtures is very general, and as they can be prepared with most primitive apparatus and in any locality, their manufacture gives employment and a respectable living to many who otherwise would not be able to obtain a livelihood. The most important exhibits of this class were the well-known Angostura bitters, which, with the liqueur and bouquet of the same name, are now made at Port of Spain in the island of Trinidad. The liqueur and bouquet are of recent manufacture and not well known, but the Angostura bitters have a world-wide reputation and a very large sale. They obtained their name from being first made at Angostura or Cuidad Bolivar, as it is now called, but the caprice of the Government and the uncertain incidence of taxation paralysed the trade, and caused Dr. Siegert, the originator and manufacturer, to move the factory to some place where he could conduct his business under a stable Government. He removed to Trinidad; and at the present time his business is so large that he exports from the island about 600,000 bottles of the bitters per annum.

Another important liqueur of more general manufacture is Falernum, made of rum and the juices or extracts of certain fruits. Amongst the exhibits were also Lime and Lemon juice, Orange wine, Sorrel liqueur, Punch, and numerous other spirituous liquids which had been carefully manufactured, possessed an agreeable flavour, and were suited for general consumption.

Queensland having, as previously stated, some of its low-lying lands situated within the tropics, its vegetation partakes of a tropical character. Although only a very young Colony sparsely populated, its prosperity advances by leaps and bounds on account of the energy and determination of the population. The growing of the sugar-cane has become an established industry, and as a matter of course the waste product from the manufacture of commercial sugar is, as in the West Indies, converted into rum. The samples of rum exhibited were not equal in quality to the rum of best West India manufacture; but some of them were of very good quality, and it is not likely that the makers will rest till they produce an article as good as any that can be manufactured.

It would not be proper to close this report without noticing a speciality exhibited from Ceylon, and which from its origin and extensive manufacture demands attention. In passing it may be noted that Ceylon, as a sugar-producing country, manufactures rum, and consequently exhibited it, but her speciality is "Arrack," made by fermentation and distillation from the sap of a particular part of the cocoa-nut tree. This sap is obtained in a somewhat remarkable manner. By a suitable arrangement the trees are coupled together by means of ropes to enable the men named toddy-drawers to pass from tree to tree without difficulty. At the proper time the toddy-drawers "prepare the flowers" of each tree, by beating the sheath containing the flowers with a wooden instrument, taking the precaution not to break the sheath. The miniature flowers thus bruised become reduced to a pulp in the course of a few weeks. When this pulping is complete the pointed end of the sheath or spathe is cut off, and the juice, which runs out and is called "sweet toddy," is collected in a vessel fastened to the end of the sheath. This toddy when collected quickly ferments, and when a sufficient quantity has been collected and fermented, the still is charged. The first distillation is called "polwakara," and is made to measure one quarter of the toddy used. After four distillations of toddy, the "polwakara" from the four distillations is put into the still and redistilled. The product of this second distillation is named "talwakara" or Arrack, and the quantity distilled over is one-half what was in the still. This spirit is usually of a strength of 18 to 20 degrees under proof strength, and if required to be of greater strength, it is distilled, and then named "ispiritu." Arrack has a very distinctive but not unpleasant flavour, and it is in general use as a beverage throughout the island of Ceylon and in certain districts of India. It is exported to Madras in large quantities for the use of the native troops.

Canada supplied specimens of spirit which, under the name of Malt and Rye Whisky, will, when tasted, be appreciated. The spirit is of good flavour and quality, but the Rye Whisky possesses a character not common to any British-made spirit. The samples were few in number, but as the Canadian Blue Book shows that 4,207,576 gallons of spirit were made in the years 1883–4, it will be evident that the samples represent a very important industry.

3. Malt Liquors, &c.

Beer and spirits having from time immemorial been the staple beverages of the people of this country, it might be expected that wherever our countrymen settled they would retain their old habits, and if the climate

were favourable they would foster and, if necessary, promote the manufacture of the beverages to which they had been accustomed. The many exhibits of malt liquor and also of spirits showed that what was to be expected has taken place in actual practice, and that in our Australian and other Colonies suitable for the brewing of malt liquor an extensive manufacture of these beverages is now carried on. The brewing industry was not so largely represented as that of wine-growing, but circumstances are different in the two cases; for as we are an extensive beer-producing country, it would be like taking coals to Newcastle to bring beer here in competition with our own. But as we are large consumers, and not producers, of wine, every effort is naturally made to induce the mother country to buy from her children, and not so largely from strangers, the wine that she wants. The importation of beer from Great Britain into the Colonies is still large, though steadily diminishing, and in some of the Colonies the import duty is so high that it is almost surprising any should be imported at all. Such protective duties prove a bounty to the Colonial brewer, and enable him to secure large profits as compared with the importer. Thus, in Victoria the import duty on beer is 9*d.* a gallon; on hops, 6*d.* per lb.; on malt, 3*s.* per bushel; on sugar, which is largely used in brewing, 3*s.* per cwt. As a consequence, under such heavy tariff duties, the Colony has turned its attention to barley-raising and hop-growing. In 1884–5 the quantity of malting barley grown reached 855,489 bushels, and the quantity of hops, which in 1879–80 was 284,480 lbs., increased to 1,573,936 lbs. in 1884–5. The number of breweries in the Colony in the latter year was 74, and the materials used in these breweries were: sugar, 13,413,456 lbs.; malt, 604,752 bushels; and hops, 752,754 lbs. The quantity of beer made was 14,400,749 gallons, or 400,021 barrels. For the same year the quantity of beer imported was 1,039,590 gallons, and exported 108,211 gallons. The excess of imported over exported beer amounted to 931,379 gallons, and if this quantity be added to the total made at the home breweries, it will give the annual consumption of beer as 15,332,128 gallons, or an average of 16 gallons per head of the population. The price of malt liquor in Melbourne at the present time is, English from 10*s.* to 12*s.* per dozen quart-bottles, and Colonial from 5*s.* to 6*s.*, or half the price. These statistics might be amplified from what is done in other Colonies, but what has been said will sufficiently illustrate the growth of the brewing industry in Australia in particular, which growth has been fostered by the demand for malt liquors, and by the high duties imposed on the same productions imported from other countries.

Of the many and various descriptions of malt liquor exhibited, nearly the whole of them included in the collection had been brewed as in this country by the high-fermentation process, and a few by the low-fermentation method as practised in Germany. Each of the two systems of brewing has its merits and demerits. By the high-fermentation process the brewer is able to brew beer which in a few days is fit for consumption, and as beer free from acid and fairly sweet is in general demand, the method of manufacture which produces the supply to meet this demand is the most popular. The brewery plant required is smaller, the capital is more rapidly turned over, and without doubt beer can be made for less money than by the German method, whose success is dependent upon large plant, extensive cellarage, and such a low temperature in the fermenting-room and cellars

that the desired temperature can only be secured by a large consumption of ice. Beer so brewed possesses qualities which are appreciated, and the increasing consumption of the beer proves that it is growing in public estimation. This Lager-beer is invariably bright when properly made, is free from acid when in proper condition, is free from the intense bitter flavour of well-brewed high-fermentation beer, and thus has a mild distinctive flavour. It should also be sold when at a low temperature, and is so sold at places of public resort: and its coolness, freedom from acidity, brightness, and the presence of a creamy head artificially produced by pumping air or carbonic acid into the cask when on draught, make it attractive to the eye and palate. Its mildness also leads people to the conclusion that the quantity of spirit in it is very small, and less than in beer brewed in the old way. This idea is, however, a mistake, for Lager-beer is quite as rich in spirit as ordinary draught or running ales. It possesses a flavour which is imparted to it partly by the mode of mashing and fermentation, and partly by the resin present in the casks, which is added to act the part of an enamel.

Of the condition of the malt liquors exhibited very much that is favourable can be said. During the hot months of summer the beer was in many cases stored in very improper places, and in certain instances the beer in bottle was kept upright for the time named. In these cases the corks so dried and shrank that the contents of the bottles were for a long period more or less in contact with the air, and this is a condition most fatal to the preservation of malt liquor. In spite, however, of these unfavourable conditions and circumstances, it is satisfactory to be able to record that nearly all the samples tasted were sound, and that although some had thrown heavy deposits, as is the case with all descriptions of beer after long standing in bottle, yet the beer was practically free from hurtful ferments, and even the worst samples were fit for consumption.

The colour, flavour, and body of the different exhibits of ale left nothing to be desired, whilst some of the samples of pale ale were so light in colour—and at the same time free from albuminous matter, showing the beer had been properly boiled—that it was evident that the malt and hops used must have been of very superior quality, and the brewing operations conducted in a most skilful manner. Some of the black beers, or porters, were not of such a rich colour as home-brewed porter; but this being simply a matter of taste, no objection could be made on this point.

The malt liquor exhibited by the Australian Colonies and New Zealand possessed a somewhat marked aromatic smell and flavour, but as the hops of native growth exhibited possessed also the same character, it was easy to trace the origin of the peculiarity in question.

The original gravities of the samples of beer exhibited varied from 1043·40 to 1090·90, and they contained from 10·0 to 19·6 per cent. of proof spirit. The maximum amount of proof spirit was high, but this was caused by the fermentation proceeding during the summer months, and it was also abnormally increased by the high temperature at which the beer was kept during that time. If the examination had taken place when the exhibits were first landed, the beer would then have been richer in extractive and lower in spirit.

Of the miscellaneous fermented beverages it is proper to notice the

fruit wines, cider and vinegar. The fruit wines, of which New Zealand is the largest exhibitor, were represented by the names they bear. They were carefully prepared, but are not likely to hold their own against the cheaper qualities of wines prepared from the grape. The cider and vinegar were such as compare with our home manufactures of the same name, except that certain of the vinegars were stronger and more pungent.

Most interesting remarks might be made on many other samples which have been examined, but the very limited space at my disposal forbids my dwelling upon them, and I must therefore bring this report to a close. It is hoped that its necessary brevity will be somewhat amplified by the very full list of exhibits which I have prepared, with the interesting explanations and information attached to many of them. The report and the list of exhibits together will, I trust, serve the purpose for which they have been prepared, viz., to be a permanent record of the contents of the Colonial Exhibition, and be the means of directing further attention to the resources of the various Colonies which contributed to it.

NEW SOUTH WALES.

Wines.

BOUFFIER BROS., Sydney, Maitland, and Cessnock.—Name of wine, Burgundy. Vineyard, Marcobrunner, Cessnock, Hunter River—30 acres. Kind of vine, Burgundy; planted, 1865. Cost of cultivation per acre, £7. Description—red colour; vintage, 1878; price, 30*s.* per case of one dozen, f.o.b.; no spirit added. Character, full-bodied, dry wine. Soil, sandy loam, with clay sub-soil; westerly aspect, flat; trellised. No. 1 Claret: Hermitage; red; vintage, 1880; 24*s.* per dozen, f.o.b.; no spirit added; light dry wine. No. 2 Claret: Hermitage; red; vintage, 1882; 18*s.* per dozen, f.o.b.; no spirit added. Pineau: Hermitage; white; vintage, 1878; 42*s.* per case of one dozen, f.o.b.; no spirit added; light hock. No. 1 Hock: Pineau; white; vintage, 1880; 30*s.* per case of one dozen, f.o.b.; no spirit added; light hock. No. 2 Hock: Reisling; light wine; vintage, 1882; 24*s.* per case of one dozen, f.o.b.; no spirit added; light hock. Tokay: Tokay; white; vintage, 1881; 30*s.* per case of one dozen, f.o.b.; light dry wine. Muscadine: Muscatel; straw; vintage, 1879; 36*s.* per case of one dozen, f.o.b.; no spirit added; full-bodied liqueur. Muscat: Muscatel; amber; vintage, 1881; 24*s.* per case of one dozen, f.o.b.; no spirit added; medium sweet wine. Malbec: Malbec; red; vintage, 1881; 21*s.* per case of one dozen, f.o.b.; no spirit added; light dry wine. Blend: Pineau and Tokay; white; vintages, 1878 and 1882; 30*s.* per case of one dozen, f.o.b.; no spirit added; light dry hock.

BRECHT, CARL, Rosemount, Denman.—Name of wine, Sherry. Vineyard, Rosemount—30 acres; area planted with this grape, 2 acres. Kind of vine, Sherry; planted, 1871; quantity of this wine produced annually, about 1000 gallons. Cost of cultivation per acre, £8. Description—straw colour; vintage, 1877; price, 15*s.* per gallon; no spirit added. Character, full-bodied. Strength, about 30 per cent. Soil, sandy loam; trained on trellis. Madeira; area planted with this grape, 4 acres: Madeira; planted, 1870; quantity of this wine produced annually, about 1200 gallons; white; vintage, 1882; 9*s.* per gallon; no spirit added; full-bodied; about 25 per cent. Claret; area planted with this grape, 8 acres: Red Hermitage and Lambruscat; planted, 1870; quantity of this wine produced annually, about 5000 gallons; red; vintage, 1883; 8*s.* 6*d.* per gallon; no spirit added; light; about 21 per cent. Pineau; area planted with this grape, 2 acres: Pineau; planted, 1871; quantity of this wine produced annually, about 1000 gallons; white; vintage, 1880; 10*s.* per gallon; no spirit added; light; about 22 per cent.

BUCHOLTZ, FREDERICK A., Fredericksberg, Mudgee.—Name of wine, Fredericksberg Port. Vineyard, Fredericksberg; 8 acres old vines and 5 acres young vines; area

planted with this grape, 1½ acre old vines and 3½ acres young vines. Kind of vine, Black Hermitage; planted, 1870; quantity of this wine produced annually, about 300 gallons. Description—dark red colour; vintage, 1882; price, 40*s.* per dozen; no spirit added. Character, full-bodied, fruity. Fredericksberg Red; area planted with this grape, 1½ acre old vines, 3½ acres young vines: Black Hermitage; planted 1870; cost of cultivation per acre, £15; price of this wine when newly made, 5*s.* per gallon; fine bouquet; light red; vintage, 1880; 30*s.* per dozen; no spirit added; full-bodied dry wine.

CAMPBELL, GEORGE, Daisy Hill, Rothbury.—Name of wine, Shiraz. Vineyard, Daisy Hill; area planted with this grape, 5 acres. Kind of vine, Shiraz; quantity of this wine produced annually, 2000 gallons. Cost of cultivation per acre, £7. Description—amber colour; vintage, 1883; price, 4*s.* 6*d.* per gallon in bulk; no spirit added. Character, full-bodied, sweet; will keep on draught; trained on trellis. Pineau; area planted with this grape, 3 acres: Pineau; quantity of this wine produced annually, 900 gallons; amber; vintage, 1883; 4*s* 6*d.* per gallon in bulk; no spirit added; full-bodied, sweet; will keep on draught. Madeira; area planted with this grape, 4 acres: Madeira; quantity of this wine produced annually, 1200 gallons. Verdôt; area planted with this grape, 1½ acre: Verdôt; quantity of this wine produced annually, 600 gallons; red; vintage, 1884; 4*s.* 6*d.* per gallon in bulk; no spirit added; full-bodied, sweet; will keep on draught. Reisling; area planted with this grape, 5 acres: Reisling; quantity of this wine produced annually, 2000 gallons: amber; vintage, 1884; 4*s.* per gallon in bulk; no spirit added; full-bodied, sweet; will keep on draught.

CARMICHAEL, G. T. & J. B., Porphyry, Seaham, Williams River.—Name of wine, Porphyry (Verdeilho). Vineyard, Porphyry—25 acres (6 acres newly planted); area planted with this grape, 3 acres. Kind of vine, Madeira; planted in 1863 and 1870; quantity of this wine produced annually, about 1000 gallons. Cost of cultivation per acre, £8. Description—white wine; vintage, 1875; price 30*s.* per dozen; no spirit added. Character, light. Strength, about 20 to 22 per cent. Soil, alluvial clay subsoil. How cultivated, espalier. Porphyry (Verdeilho); area planted with this grape, 3 acres: Madeira, planted in 1863 and 1870; quantity of this wine produced annually, about 1000 gallons: white; vintage, 1876; 30*s.* per dozen; no spirit added; light; about 20 to 22 per cent. Porphyry; area planted with this grape, 19 acres: Reisling, planted in 1863, 1870, 1871, and 1883; quantity of this wine produced annually, about 5000 gallons; white; vintage, 1883; 21*s.* per dozen, 6*s.* 6*d.* per gallon; no spirit added; light dry wine; 18 to 20 per cent.

COX, HON. GEORGE HENRY, Winbourn, Mulgoa, on eastern slope of the Blue Mountains.—Name of wine, Reisling. Vineyard, Winbourn—15 acres; area planted with this grape, 4 acres. Kind of vine, Reisling; planted, 1865; quantity of this wine produced annually, about 1000 gallons. Cost of cultivation per acre, £10. Price of wine newly made, 5*s.* per gallon. Description—light rich colour; vintage, 1883; price, 6*s.* per gallon; no spirit added. Character, light. Soil, red sandy loam; 200 feet above sea-level; eastern aspect; trained to stakes.

DAVIES & CO., A. E., Mount Huntly, Allandale.—Name of wine, Madeira. Vineyard, Mount Huntly—35 acres; area planted with this grape, 7 acres. Kind of vine, Madeira; planted, 1860; quantity of this wine produced annually, 4000 gallons. Cost of cultivation per acre, £10. Description—white colour; vintage, 1883. Character, full-bodied. Soil, rich alluvial; trained to wire.

FALLON, JAMES T., Murray Valley Vineyard, near Albury; and 91 Pitt Street, Sydney.—Name of wine, Hochheimer. Vineyard, Murray Valley—200 acres. Kind of vine, Hochheimer. Cost of cultivation per acre, £10. Price, when newly made, 2*s.* 6*d.* per gallon. Description—white; vintage, 1868; no spirit added. Soil, calcareous, volcanic, chocolate colour, interspersed with quartz; lime sub-soil; trained to stakes; ploughed between stakes, direct cross, and diagonal; hoed round vines. Burgundy: Burgundy; 2*s.* 6*d.* per gallon; red; vintage, 1868; no spirit added; full-bodied. Hermitage: Hermitage; 2*s.* 6*d.* per gallon; red; vintage, 1874; no spirit added; full-bodied. Reisling: Reisling; 2*s.* 6*d.* per gallon; white; vintage, 1874; no spirit added; full-bodied. Tokay: Tokay; 2*s.* 6*d.* per gallon; white; vintage, 1874; no spirit added; full-bodied. Aucarôt: Aucarôt; 2*s.* 6*d.* per gallon; white; vintage, 1880; no spirit added; full-bodied.

FLEMING, GEORGE T., Hauteville, Albury.—Name of wine, Reisling. Vineyard, Hauteville—8 acres; area planted with this grape, 4 acres. Kind of vine, Reisling; planted, 1865; quantity of this wine produced annually, 900 gallons. Cost of cultivation per acre, £6. Description—white colour; vintage, 1882; price, 6*s.* per gallon.

Character, light. Soil, decomposed granite, sloping to the west; trained to stakes. Verdeilho; area planted with this grape, 1 acre: Verdeilho, planted, 1865; quantity of this wine produced annually, 120 gallons; white; vintage, 1881; 6*s.* per gallon; full-bodied. Shiraz; area planted with this grape, 2 acres: Black Shiraz; planted, 1865; quantity of this wine produced annually, 400 gallons; red; vintage, 1882; 6*s.* per gallon; full-bodied.

FRANCIS, GEORGE, Douglas Vale, Port Macquarie.—Name of wine, Isabella Port. Vineyard, Douglas Vale—6 acres; area planted with this grape, 6 acres. Kind of vine, Isabella; planted, 1863; quantity of this wine produced annually, about 3500 gallons. Cost of cultivation per acre, £100, that is clearing and planting till the vines bear. Description—sweet red wine; vintages, 1881 and 1882; price, 7*s.* per gallon in bulk; no spirit added. Character, good-bodied. Soil, red chocolate; northern aspect; altitude of vineyard, about 100 feet above sea-level; trained on trellis.

FRÈRE, LÉONCE, St. Hilaire, near Albury.—Name of wine, Australian Champagne, Dry. Vineyard, St. Hilaire—55 acres; area planted with this grape, 30 acres. Kind of vine, White Hermitage; planted, 1877; quantity of this wine produced annually, 1000 dozen. Cost of cultivation per acre, £5. Description—light sparkling white wine; vintage, 1881; price £3 10*s.* per two-dozen case; price obtained at previous exhibitions, £3 10*s.* per two-dozen case; no spirit added. Character, light dry wine. Strength, 20 per cent. P.S. Soil, chocolate colour; trained to stakes. Australian Champagne, Sweet: White Hermitage; planted, 1877; quantity of this wine produced annually, 2000 dozen; sparkling white, sweet; vintage, 1881; £3 per dozen; price obtained at previous exhibitions, £3 per dozen; no spirit added; slightly sweet.

GORUS & SON, JOHN T., Eschol Park, Minto, near Campbeltown.—Name of wine, Muscat. Vineyard, Eschol Park. Kind of vine, Muscat; vintage, 1883; no spirit added. Strength about 20 per cent. P.S. Madeira: Madeira; vintage, 1880; about 20 per cent. P. S.

GREEN, WALTER C., Johannesberg, Allandale, Hunter River.—Name of wine, Reisling. Vineyard, Johannesberg—17 acres; area planted with this grape, 5 acres. Kind of vine, Shepherd's Reisling; planted, 1881. Cost of cultivation per acre, £10. Description—white colour; vintage, 1884; price 4*s.* per gallon. Character, full-bodied. Soil, surface red, limestone formation, and sub-soil; trained to stakes.

HARBOTTLE, ALSOP, & Co., Ettamogah, near Albury.—Name of wine, Ettamogah Red. Vineyard, Ettamogah—26 acres; area planted with this grape, 14 acres. Kind of vine, Black Shiraz, Pineau noir, Mataro, Grenache, and Carbinet sauvignon; planted, 1864 to 1871; quantity of this wine produced annually, 3500 gallons. Cost of cultivation per acre, £6. Description—red colour; vintage, 1878; price, 18*s.* per dozen (cased); no spirit added. Character, light. Soil, decomposed granite, chocolate, and white loam; slopes to the east and west; trained to stakes. Ettamogah Reisling; area planted with this grape, 4 acres: Reisling; planted, 1866 to 1870; quantity of this wine produced annually, 1200 gallons; dry white; vintage, 1877; light; about 20 per cent. Ettamogah Muscat; area planted with this grape, 5 acres: Brown Muscat; planted, 1862 to 1865; quantity of this wine produced annually, about 900 gallons: brown; vintage, 1884; 3 per cent. spirit added: liqueur. Ettamogah Aucarôt; area planted with this grape, 1 acre: Aucarôt; planted, 1873; quantity of this wine produced annually, 200 gallons; white; vintage, 1884; full-bodied.

HILL, JOHN, Hannahton, Whittingham.—Name of wine, Madeira White. Vineyard, Hannahton—11 acres; area planted with this grape, half an acre. Kind of vine, Madeira; planted, about 1870; quantity of this wine produced annually, 100 gallons. Cost of cultivation per acre, about £10. Description—white colour; vintage, 1880; no spirit added. Character, full-bodied. Soil, chocolate colour, and elevated; trained to stakes. Hermitage; Red; area planted with this grape, half an acre: Red Hermitage; planted, about 1870; quantity of this wine produced annually, 100 gallons; red; vintage, 1880; no spirit added; full-bodied.

HOLMES, J. B., "The Wilderness," Allandale, Hunter River.—Name of wine, Red Hermitage. Vineyard, "The Wilderness," parish of Rothbury—40 acres; extent of area planted with this grape, 14 acres. Kind of vine, Red Hermitage; planted at different dates from 1864 to 1883; quantity of this wine produced annually, 2000 gallons. Cost of cultivation per acre, £8. Price of this wine when newly made at vineyard, 4*s.* per gallon. Description—Red Hermitage, dark colour; vintage, 1884; price, 5*s.* per gallon in bulk; no spirit added. Character, full-bodied, dry. Soil, red marl; chalk sub-soil; situated on the spur of a ridge, having an aspect in each direction; cultivated with plough and fork; trained espalier; stakes with one wire, 3 feet from

ground. White Madeira; extent of area planted with this grape, 10 acres: White Madeira; planted at different dates from 1864 to 1883; quantity of this wine produced annually, 2000 to 4000 gallons; price of this wine when newly made at vineyard, 5*s.* per gallon; dark sherry; vintage, 1880; price 7*s.* per gallon in bulk; no spirit added; full-bodied, sweet.

JACK, DAVID, Fernmount, Inverell, on the western slopes of New England.—Name of wine, Hermitage No. 3. Vineyard, Fernmount; area planted with this grape, 6 acres. Kind of vine, Hermitage; planted 1873; quantity of this wine produced annually, about 400 gallons per acre. Cost of cultivation per acre, £10. Price of this wine when newly made, 4*s.* per gallon. Description—red colour; vintage, 1884; price, 6*s.* per gallon; no spirit added. Character, full-bodied. Nature of soil, &c., red soil; eastern aspect; trained to stakes and wires. Hermitage No. 2; area planted with this grape, 6 acres: Hermitage; planted 1873; quantity of this wine produced annually, about 400 gallons per acre; price of this wine newly made, 4*s.* per gallon; red; vintage, 1885; 6*s.* per gallon; no spirit added; full-bodied.

KELMAN, JAMES, Kirkton, Branxton, Hunter River.—Name of wine, Kirkton; sweet red. Vineyard, Kirkton; 32 acres in bearing, 13 acres young vines. Kind of vine, different varieties. Cost of cultivation per acre, £7. Description—red colour; sweet, strong; vintage, 1884; about 10 per cent. spirit added. Character, full-bodied. Strength, about 30 per cent. P.S. Nature of soil, sand 2 to 10 feet deep, gravel, and clay sub-soil. Aspect, east and north-east. Elevation, 150 feet. Vines, 6 feet apart; trained to trellis. Kirkton; sweet white; different varieties; white; sweet; strong; vintage, 1883; about 10 per cent. spirit added; full-bodied; about 30 per cent. P.S. Kirkton Hermitage; area planted with this grape, 12 acres: Red Hermitage; planted, 1845 to 1864; quantity of this wine produced annually, 5000 gallons; red, full colour; vintage, 1883; no spirit added; Bordeaux, dry; medium strength; about 22 per cent. P.S. Kirkton Claret; area planted with this grape, 12 acres: Red Hermitage; planted, 1845 to 1864; claret; light red; vintage, 1883; no spirit added; light dry wine; about 18 per cent. P.S. Kirkton White Reisling; area planted with this grape, 5 acres: Shepherd's Reisling; planted, 1868 to 1870; quantity of this wine produced annually, about 2500 gallons; straw; vintage, 1878; no spirit added; light dry wine; 20 per cent. P.S. Kirkton White Verdeilho; area planted with this grape, 6 acres: Verdeilho; planted, 1864 to 1870; quantity of this wine produced annually, about 2400 gallons; golden; vintage, 1875; no spirit added; full-bodied, dry; about 22 per cent. P.S. Kirkton Hock; area planted with this grape, 10 acres: Reisling, Verdeilho, Hermitage, and Pineau; planted, 1868 and 1870; pale; vintage, 1877; no spirit added; hock, light, dry; about 20 per cent. P.S.

LINDEMAN, H. J., Carrawa, Paterson River.—Name of wine, Carrawa Red Hermitage. Vineyard, Carrawa. Description—red wine; vintage, 1883; no spirit added. Carrawa Red; red; vintage, 1881; no spirit added. Carrawa White; white; vintage, 1881.

MATHER, THOMAS, Roslyn, Inverell.—Name of wine, Tokay. Vineyard, Roslyn—20 acres (12 only bearing); area planted with this grape, 1½ acres. Kind of vine, Tokay; planted, 1875; quantity of this wine produced annually, 200 gallons. Cost of cultivation per acre, £13. Price of this wine when newly made, 3*s.* 6*d.* per gallon. Description—white wine; vintage, 1883; price, 6*s.* 6*d.* per gallon; no spirit added. Character, full-bodied. Strength, about 28 per cent. P.S. Nature of soil, red soil; aspect, east and north, on a hill; trellised on three wires to stakes. Verdeilho or Madeira; area planted with this grape, 3 acres: Verdeilho or Madeira; planted, 1875; quantity of this wine produced annually, about 1000 gallons; price of wine when newly made, 2*s.* 6*d.* per gallon; white; vintage, 1883; 3*s.* 6*d.* per gallon; no spirit added; full-bodied; 28 per cent. P.S. Shiraz; area planted with this grape, 1 acre: Shiraz; planted, 1875; quantity of this wine produced annually, 500 gallons; price of this wine when newly made, 2*s.* per gallon; white; vintage, 1883; 3*s.* per gallon; no spirit added; full-bodied; 26 per cent. P.S. Reisling; area planted with this grape, 1 acre: German Reisling; planted 1875; quantity of this wine produced annually, 400 gallons; price of wine when newly made, 2*s.* 6*d.* per gallon; white; vintage, 1883; 3*s.* per gallon; no spirit added; light wine; about 24 per cent. P.S. Reisling; area planted with this grape, 1 acre: Reisling; quantity of this wine produced annually, 400 gallons; price of wine when newly made, 2*s.* 6*d.* per gallon; white; vintage, 1882; 4*s.* per gallon; no spirit added; light; about 23 per cent. P.S. Claret: Hermitage, Malbec, Pineau, and Verdeilho; planted, 1875; price when newly made at vineyard, 2*s.* per gallon; red; vintage, 1885; 2*s.* 6*d.* per gallon; no spirit added; light; 24 per cent.

P.S. Hermitage; area planted with this grape, 8 acres: Hermitage; planted, 1875; quantity of this wine produced annually, 3000 to 4000 gallons; price of wine when newly made, 2*s.* per gallon; red; vintage, 1883; 3*s.* per gallon; no spirit added; light; 25 per cent. P.S.

MURRAY, ANDREW, Hillside, Bannockburn, near Inverell.—Name of wine, Hermitage. Vineyard, Hillside—14 acres; area planted with this grape, 5 acres. Kind of vine, Hermitage; date of planting, 1877; quantity of this wine produced annually, about 1500 gallons. Cost of cultivation per acre, £10. Price of wine when newly made, 3*s.* per gallon. Description—red colour; vintage, 1883; price 5*s.* per gallon; no spirit added. Character, full-bodied. Nature of soil, &c., volcanic red soil; situation, high; well drained; trained on trellis. Salvanna or Tokay; area planted with this grape, 4 acres: Salvanna or Tokay; date of planting, 1877; quantity of this wine produced annually, about 1100 gallons; price of wine when newly made, 3*s.* per gallon; white; vintage, 1884; 5*s.* per gallon; no spirit added; full-bodied. Malbec; area planted with this grape, 3 acres: Malbec; date of planting, 1877; price of this wine when newly made, 3*s.* per gallon; red; vintage, 1884; 5*s.* per gallon; no spirit added; full-bodied.

MUNRO, ALEXANDER, Bebeah, near Singleton.—Name of wine, Sherry. Vineyard, Bebeah—70 acres. Kind of vine, mixed grapes; planted, 1863 to 1870; quantity of this wine produced annually, about 3000 gallons. Cost of cultivation per acre, £7 10*s.* Description—sweet white wine; vintage, 1877; price, 30*s.* per dozen, or 12*s.* 6*d.* per gallon; about 2 per cent. of spirit added. Character, full-bodied; not sweet enough for liqueur. Nature of soil, &c., rich dark loam, undulating plains; stakes with two wires trellised. Port: mixed grapes; planted 1862 to 1868; quantity of this wine produced annually, about 3000 gallons; sweet red; vintage, 1878; 30*s.* per dozen, or 12*s.* 6*d.* per gallon; about 3 per cent. of spirit added; full-bodied. Pineau (old); area planted with this grape, about 5 acres: Pineau (blanc); planted, 1865; quantity of this wine produced annually, from 2000 to 3000 gallons; white; vintage, 1878; 21*s.* per dozen, or 7*s.* 6*d.* per gallon; no spirit added; full-bodied. Burgundy; area planted with this grape, about 2½ acres; Burgundy (or Pineau noir); planted, 1866; quantity of this wine produced annually, from 500 to 1500 gallons, according to season; red; vintage, 1880; 21*s.* per dozen, or 7*s.* 6*d.* per gallon; no spirit added; full-bodied. Malbec; area planted with this grape, about 3 acres: Malbec; planted, 1866; quantity of this wine produced annually, from 700 to 1800 gallons, according to season; red; vintage, 1881; 18*s.* per dozen, or 6*s.* per gallon; no spirit added; full-bodied. Reisling; area planted with this grape, about 6 acres; Shepherd's Reisling; planted, 1865; quantity of this wine produced annually, from 2000 to 4000 gallons, according to season; white; vintage, 1883; 15*s.* per dozen, or 5*s.* per gallon; no spirit added; light hock. Hermitage; area planted with this grape, about 8 acres: Red Hermitage; planted, 1862 to 1865; quantity of this wine produced annually, from 2000 to 6000 gallons, according to season; red; vintage, 1883; 15*s.* per dozen, or 5*s.* per gallon; no spirit added; light, medium. Shiraz; area planted with this grape, about 10 acres: White Shiraz; planted, from 1863 to 1865; quantity of this wine produced annually, from 2500 to 10,000 gallons, according to season; white; vintage, 1883; 15*s.* per dozen, or 5*s.* per gallon; no spirit added; light. Claret: mixed grapes, or made by blending different wines; quantity of this wine produced annually, from 4000 to 5000 gallons; red; vintage, 1883; 15*s.* per dozen, or 5*s.* per gallon; no spirit added; light.

WILKINSON, JOHN A., Coolalta, Branxton, and 354½ George Street, Sydney.—Name of wine, Coolalta Hermitage. Vineyard, Coolalta—22 acres. Kind of vine, Hermitage; planted, 1870. Cost of cultivation per acre, £10. No spirit added. Vintage, 1877. Character, medium. Strength, about 23 per cent. P.S. Nature of the soil, &c., calcareous rich soil, on northern slope of high ridge; trained to stakes. Coolalta Shiraz and Pineau; area planted with this grape, half an acre: Shiraz and White Pineau; planted, 1870; quantity of this wine produced annually, 4000 gallons; pale gold; vintages, 1881 and 1882; 8*s.* per gallon, or 21*s.* per dozen; 3 per cent. of spirit added; full-bodied; about 24 per cent. P.S. Coolalta Pineau and Madeira; area planted with this grape, 5 acres: White Pineau and Verdeilho; planted, 1870; quantity of this wine produced annually, about 1000 gallons; pale gold; vintage, 1884; 8*s.* per gallon, or 21*s.* per dozen; no spirit added; medium; about 22 per cent. P.S. Coolalta Shiraz and Madeira; area planted with this grape, 4 acres; Shiraz and Verdeilho; planted, 1870 and 1879; quantity of this wine produced annually, 8000 gallons; pale gold; vintage, 1884; 8*s.* per gallon, or 21*s.* per dozen; no spirit added; medium; 22 per cent. P.S. (This wine is a blend of Shiraz and Verdeilho put together at vintage; not

fined till June, 1885. A good experiment to see how young wines travel.) Coolalta Malbec; area planted with this grape, 1 acre: Malbec; planted, 1870; quantity of this wine produced annually, about 800 gallons; dark red; vintage, 1883; 8*s.* per gallon, or 21*s.* per dozen; no spirit added; light, clear, pleasant flavour; about 20 per cent. P.S. Coolalta Madeira; area planted with this grape, 2 acres: Verdeilho; planted, 1870; quantity of this wine produced annually, about 7000 gallons; pale gold; vintage, 1883; no spirit added; full-bodied; about 23 per cent. P.S. Coolalta Red Hermitage and Malbec; area planted with this grape, 8 acres: Red Hermitage and Malbec; planted, 1870 and 1879; quantity of this wine produced annually, about 2000 gallons; dark red; vintage, 1884; no spirit added; medium, fruity wine; about 23 per cent. P.S.

VICTORIA.

Wines.

AUSTRALIAN FREEHOLD LAND AND PRODUCE COMPANY, Limited, Chateau Tahbilk Vineyard (Arthur H. L. Browne, Secretary, 131 Collins Street West, Melbourne)—350 acres. Yield per acre, 300 gallons. Cost of cultivation not given. Carbinet, red, full, dry, 1882 vintage; Carbinet, 1878; Hermitage, Chablis, Pedro Ximines, Reisling, Claret, Hock, 1883; Carbinet, 1882; Carbinet, Reisling, Hock, Hermitage, Hermitage and Malbec, Pedro Ximines, Claret, Chablis, Chasselas, 1883.

BEST, JOSEPH, Great Western Vineyard, Great Western—50 acres. Yearly production, from 8000 to 13,000 gallons. Cost of cultivation not estimated. Hock, 1878 vintage; Claret, 1877.

BLAYNEY, THOMAS, Goulburn Valley Vineyard, Nagambie—30 acres. Production per acre, about 200 gallons. Cost of cultivation per acre, £8. Hermitage.

BRACHE & Co., 112 Collins Street West, Melbourne. No particulars. Carbinet, 1882 vintage; Carbinet, 1881; Carbinet, 1880; Shiraz, dry, 1879; Verdeilho, dry, very full body, 1878; Hermitage, white medium, 1878; Reisling, very full body, 1875; Verdeilho, dry, 1878; Reisling, light and delicate, 1873; Reisling, medium strength, 1877; Hermitage, white, light and delicate, 1882; Hermitage, white—character, Chablis, 1883.

BRENSING, E., Nagambie—10 acres. Light. Yield per acre, 300 gallons. Cost of cultivation per acre, £8. Reisling, 1884 vintage; Burgundy, 1884.

BRUHN, ALBERT, Emu Vineyard, Sandhurst—34 acres. Yield per acre, 200 gallons. Cost of cultivation per acre, £5. Chablis, medium, 1883 vintage; Verdeilho, fruity, 1883; Hermitage, fruity, 1883; Carbinet, fruity, 1884; Hock, dry and delicate, 1884. Carbinet, fruity, 1882; Pedro Ximines, fruity, 1883.

BUCHANAN, CHARLES, Vine Bank Vineyard, Ondit—8 acres. Average produce per acre, 250 gallons. Cost of cultivation per acre, £5. Hermitage, white, 1883 vintage; Carbinet, 1885.

BUSSE, F., & SONS, Burrabunnia Vineyards, Burrabunnia—50 acres. Yield per acre, from 200 to 300 gallons. Cost of cultivation per acre, £5. Tokay, 1883 vintage; Aucorot, Reisling, Verdeilho, 1883; Reisling, 1885; Malbec, 1883; Malbec, 1885; Muscat, Burgundy, 1883; Shiraz, 1885; Shiraz, 1883; Aucorot, 1885.

CALDWELL, ROBERT, & Co., Wine Merchants, Collins Street West, Melbourne. Origin not stated. Age of wine, over 3 years. Chablis, Reisling, Hock, Claret, Port, Muscat.

CAUGHEY, ALEXANDER, Mount Prior Vineyard, Gooramadda—225 acres. Yield per acre, 200 gallons. Cost of cultivation per acre, £5. Yearly production, from 45,000 to 50,000 gallons. Ivanhoe, white, 1885 vintage; Hermitage, white, 1885; Pedro Ximines, Gouais, Reisling, 1885; Shiraz, Red Muscat, Motaro, Claret, Carbinet.

CHATEAU YERING WINE COMPANY, 32 Eastern Market Cellars, Melbourne. No particulars given. Sauvignon, 1883 vintage; Hermitage, Burgundy, 1883; Chasselas, Tokay, 1884; White Hermitage, 1884; Tokay, 1883.

CURRIE, JOHN, Merchant, Little Collins Street West, Melbourne. Age, 3 to 5 years. Price of wine in Melbourne, 6*s.* 6*d.* per gallon. Origin not given. Royal Turk, Carbinet, Verdeilho, Shiraz.

DAVIES, J., "Ngarveno," Moonee Ponds—16 acres. Yearly production 5,000 gallons. Cost of cultivation not stated. Hock, 1882 vintage.

DE CASTELLA & ROWAN, St. Hubert's Vineyard—260 acres. Produce per acre, 300 gallons. Cost of cultivation per acre, £10. Quantity in bulk and bottle ready

for exhibition, 10,000 gallons. Annual produce, 60,000 gallons. Chasselas, 1879 vintage; Chasselas, 1883; Chasselas, 1885; Tokay, 1879; Reisling, 1883; Reisling, 1884; White Hermitage, 1883; White Hermitage, 1885; Sauvignon, 1883; Sauvignon, 1885; Hermitage, 1883; Burgundy, White Hermitage, 1884; Red Hermitage, 1883.

De Pury, G., Yeringberg Vineyard, St. Hubert's—60 acres. Yearly production, 2000 gallons. Cost of cultivation per acre, £10. Hermitage, white, dry, 1883 vintage; Tokay, white, light.

Fox, A. W., Emu Creek Vineyard, Emu Creek, Bendigo—37 acres. Yield per acre, 100 gallons. Cost of cultivation per acre, £4 to £5. Has bought for some years the grapes of 10 to 14 small vineyards. Muscat, Carbinet, Hermitage, Claret, Verdeilho, Madeira, Reisling, Chasselas.

Fraser, Hugh, "Olive Hills" Vineyard, Brown's Plains—25 acres. Yield per acre, 300 gallons. Cost of cultivation per acre, £5. Verdeilho, sweet, white, 1884 vintage; Shiraz, sweet, full-bodied, 1885.

Fuller, Charles, Amphitheatre, Inverleigh. No particulars. Cherry Wine.

Fulton, E. Graham, Echuca Vineyard (Office, 32 Collins Street East, Melbourne)—60 acres. Average production per acre, 250 gallons and upwards. Cost of cultivation, not estimated. Reisling, 1883 vintage; Verdeilho, white, 1882; Hock, 1882; Hermitage (Claret), red, 1882; Tongola, 1879; Tongola, 1880; Reisling, white, dry, 1882; Reisling, 1882.

Gemmel, John, Fairlawn Vineyard, Wooragee, near Beechworth—7 acres. Yield per acre, 250 to 400 gallons. Cost of cultivation per acre, £5. Tokay, Reisling, Shiraz, Malbec.

Giannetti, Battista, Lombardy Vineyard, Bealiba—4 acres. Yearly production, 2000 gallons. Cost of cultivation per acre, £6. Hermitage, red, 1885 vintage; Hock, white, 1885.

Gooch, H. M., & Co., 99 Collins Street West. No particulars as to origin. Hermitage, white, 1882 vintage; Claret, Australian, 1882; Hock, Australian, 1883.

Graham Bros., Netherby Vineyard, Rutherglen. Wine.

Grosse, F., Bendigo Wine Cellars, 106 Collins Street West, Melbourne. No particulars as to origin, &c. White, Reisling, Pedro Ximines, Chablis, Hock, White Hermitage, Red Hermitage, Claret, Carbinet, Hermitage, 1883 vintage.

Hanlon, Lawrence, Katupna Vineyard, Katupna—14 acres. Yield per acre, 230 gallons. Cost of cultivation per acre, £8. Hermitage, black, 1885 vintage.

Hughes, William, Quondong Vineyard, Rutherglen—80 acres. Average production per acre, 150 gallons. Cost of cultivation per acre, £4 to £5. Muscat, brown, 1885 vintage; Shiraz, 1885.

Kahland, Jochim, Merchant, King Street, Sandhurst. No particulars of origin, &c. Carbinet, red, full-bodied, 1882 vintage; Burgundy, 1882; Muscat, red, light-bodied, 1883; Hermitage, Verdeilho, Reisling, 1883.

Kitz, Louis, & Son, Wine Merchants, Selborne Chambers, Chancery Lane, Melbourne. No particulars given as to origin, &c. Reisling, 1882 vintage; Hock, 1881; Hermitage, 1882; Verdeilho, 1883; Reisling (Amontillado bouquet), 1880; Carbinet, 1882; Frontignac, 1879; Brown Muscat, 1883; Chablis, 1882; Dry Shiraz, 1883.

Kurrle, Robert F., Rosenthal Vineyard, Sunbury—45 acres. Yield per acre, from 150 to 200 gallons. Cost of cultivation per acre, £5. Hermitage, 1881 vintage; Hermitage, 1882; Verdeilho, 1883; Reisling, 1880.

Lang, Matthew, & Co., Merchants, 83 Collins Street West, Melbourne. No particulars given as to origin, &c. Malbec, Shiraz, Reisling, 1883 vintage; Hock, 1876; Aucorot, 1883; Pedro Ximines, Tokay, Burgundy.

Lawrence & Adam, 61 William Street, Melbourne. No particulars as to origin. Muscat, 1879 vintage.

Mitchell, David, Gooramadda Vineyard (Town address: Burnley Street, Richmond)—40 acres. Produce per acre, 150 gallons. Cost of cultivation per acre, £4. Pedro Ximines, Reisling, 1884 vintage; Shiraz, dry, 1884; Shiraz, fruity, 1884.

Morris, G. F., & Sons, Fairfield Vineyard, Brown's Plains—300 acres. Yearly production, 75,000 gallons. Cost of cultivation per acre, £4. Reisling, Claret, Port, Verdeilho, Carbinet, Chablis, Shiraz, Hermitage, Muscat, Grenache, 1884 vintage. Also Wine Trophy, consisting of large wine casks.

Oakley, Adams, & Co., Merchants, Flinder's Lane East, Melbourne. Old wine. No particulars as to growers, &c. Hermitage, Verdeilho, Claret, Chablis, Port.

Pearce, Joseph, Crumplehorn Vineyard, Wahgunyah—23 acres. Produce per acre, 150 to 300 gallons. Shiraz, 1885 vintage.

SCHROEDER, E., Imperial Vineyard, Chinaman's Creek, Castlemaine. No particulars given. Tokay.

SCHWERKOLT, AUGUST, Ringwood. No particulars given. Peach Wine, Cherry Wine.

SHAW, T. K., Goornong Vineyard, Goornong—10 acres. Yearly production, 1000 gallons. Cost of cultivation per acre, £5. Wine.

SMITH, DANIEL, Beauséjour Vineyard, Eversley—30 acres. Yearly production, 6500 gallons. Cost of cultivation per acre, £3. Hermitage, Chasselas, 1883 vintage; Hermitage, 1882; Hermitage, 1884; Chasselas, 1883; Burgundy, 1884; Hermitage, 1884; Burgundy, 1884; Hermitage, 1883; Chasselas, 1882; Burgundy, 1882.

SMITH, GEORGE SUTHERLAND, & SONS, All Saints' Vineyard, Wahgunyah—150 acres. Produce per acre, 300 gallons. Cost of cultivation per acre, £7 10s. Chablis, Claret, 1880 vintage; Port, 1878; Muscat, 1879; Hock, Hermitage, 1880.

SMITH, J. & C., Mundadda Vineyard, Barnawartha—175 acres. Yearly production at present, 10,000 to 15,000 gallons; expected, when wines in full bearing, 45,000 gallons. Cost of cultivation per acre, £4 to £5. Muscat, 1885 vintage.

SNART, ROBERT, Gooramadda—25 acres. Average yield per acre, 200 gallons. Cost of cultivation per acre, £4. Reisling, Grenache, Shiraz, 1885 vintage.

TRINKAUS, ALBERT, Wintergarden Vineyard, Muckleford—1 acre. Yield per acre, 300 gallons. Cost of cultivation per acre, £10. Hermitage, 1884 vintage; Hermitage, 1885; Reisling, 1884.

SOUTH AUSTRALIA.

Wines.

1. AULD, WM. P., Auldana.—(1) Auldana Ruby, No. 1; name of vineyard, Auldana; extent, 100 acres; colour, ruby; character, dry, light; vintage, 1871; names of grapes from which wine is made, Mataro, Shiraz, and Carbinet ["Wine of this vintage was shipped to London in 1874"]; age of vines, from 1856; nature of soil, decomposed iron and limestone, good loam; elevation, 600 ft.; how cultivated, ploughed, &c., and long and short pruning; number of acres of grapes from which this wine is made, thirty; of Claret type. (2) White, A.; colour, amber; character, light, dry; vintage, 1873; names of grapes from which wine is made, Verdeilho, Palomino, Blanco, Doradilla, and Gouais, fermented together; age of vines, from 1856; number of acres of grapes from which this wine is made, thirty; of Chablis type.

2. AULDANA VINEYARD PROPRIETORS, Auldana.—(1) Auldana Ruby, No. 14; name of vineyard, Auldana; extent, 120 acres; colour, ruby; character, medium, dry; vintage, 1883; name of grapes from which wine is made, Mataro and Shiraz; age of vines, from 1856 to 1884; nature of soil, decomposed iron and limestone, good loam; elevation, 600 ft.; how cultivated, ploughed, &c., long and short pruning; acres of grapes from which this wine is made, sixty; of Claret type. (2) Auldana Ruby, C.; colour, ruby; character, medium, dry; vintage, 1883; grapes from which wine is made, Shiraz, Mataro, and Carbinet; number of acres of vines from which this wine is made, 100; of Claret type. (3) Ruby Cup; colour, ruby; character, full-bodied, sweet; vintage, 1883; name of grapes from which this wine is made, Shiraz and Mataro; number of acres of grapes from which this wine is made, 100; of Claret type. (4) Auldana Ladies' Pride; colour, white; character, full-bodied, sweet; vintage, 1883; name of grape from which wine is made, Grenache; not fermented with the skins nor pressed; number of acres of grapes from which this wine is made, ten; of Malaga type. (5) Auldana Cup; colour, white; character, light, dry; vintage, 1883; name of grapes from which wine is made, Verdeilho, Doradilla, Riesling, and a few Muscatels; age of vines, from 1856; number of acres of grapes from which this wine is made, sixty; of Chablis type. (6) Auldana Riesling; colour, white; character, light, dry; vintage, 1883; name of grape from which wine is made, Riesling; age of vines, from 1856; number of acres of grapes from which wine is made, twenty; of Hock type. (7) Auldana Muscatel; colour, white; character, light, dry; vintage, 1883; name of grape from which wine is made, Muscatel; age of vines, from 1856; number of acres of grapes from which this wine is made, forty; of Constantia type. (8) One case of soil from Auldana vineyard.

3. BAKER, RICHMOND, Page Street, Adelaide.—Wine.

4. DAVENPORT, SIR SAMUEL, Beaumont, near Adelaide.—(1) Sauterne wine; name of vineyard, Beaumont; extent, twenty-five acres; selling price f.o.b., 16*s.* per dozen or

6*s*. per gallon; colour, white; character, light; vintage, 1883; name of grape from which wine is made, Sercial; age of wine, ten to fifteen years; nature of soil, reddish mould, with slate and lime mixtures; aspect, westward; elevation, 500 ft.; how cultivated, by horse and hand; number of acres of grapes from which this wine is made, fourteen acres; number of gallons manufactured last vintage, 2500; of Sauterne type. (2) Dry Sauterne wine; other particulars as above; of Sauterne type. (3) Chateau Beaumont wine; selling price f.o.b., 15*s*. per dozen and 5*s*. per gallon; colour, red; character, full-bodied, sweet; vintage, 1871; name of grapes from which wine is made, Grenache and Shiraz, Mataro, and Gouais; age of vines, twenty-three years; number of acres of grapes from which this wine is made, seven; of Burgundy type. (4) Chablis wine; selling price f.o.b., 13*s*. per dozen and 4*s*. per gallon; colour, white; character, light; vintage, 1884; name of grape from which wine is made, Doradilla; age of vines, ten years; number of acres of grapes from which this wine is made, twelve; number of gallons manufactured last vintage, 1000; of Chablis type. (5) Shiraz wine; selling price f.o.b., 40*s*. per dozen; colour, red; character, liqueur; vintage, 1868; name of grape from which this wine is made, Shiraz; age of vines, twenty-four years; number of acres of grapes from which this wine is made, three; of Hermitage type. (6) Port wine; selling price f.o.b., 8*s*. 6*d*. per gallon, 20*s*. per dozen; colour, red; character, full-bodied; vintage, 1883; name of grape from which this wine is made, Grenache; age of vines, twenty-four years; number of acres of grapes from which this wine is made, two; number of gallons made last vintage, 600; of Port type. (7) Claret; selling price f.o.b., 20*s*. per dozen; colour, red; character, light; vintage, 1884; name of grapes from which this wine is made, Shiraz and Carbinet; age of vines, twenty-four years; number of acres of grapes from which this wine is made, three; of Claret type. (8) Crême d'Alicante wine; selling price, 125*s*. per dozen; colour, red; character, liqueur; vintage, 1883; name of grape from which this wine is made, Grenache; age of vines, twenty-four years; number of acres of grapes from which this wine is made, two; of a Liqueur character. (9) Hermitage wine; selling price, 12*s*. per dozen, 4*s*. per gallon; colour, red; character, full-bodied; age of vines, twenty-four years; number of acres of grapes from which this wine is made, three; of Burgundy type. (10) Vin Ordinaire; selling price f.o.b., 6*s*. per dozen, 2*s*. per gallon; colour, red; character, light; vintage, 1885; grapes from which wine is made, second crushing; age of vines, ten to fifteen years; number of gallons manufactured last vintage, 2000. (11) Madeira wine; selling price f.o.b., 20*s*. per dozen, 5*s*. per gallon; colour white; character, full-bodied; vintage, 1875; name of grape from which wine is made, Sercial; of Sauterne type.

5. ELDER, SIR THOMAS, Glen Osmond.—(1) Madeira wine; name of vineyard, Birksgate, Glen Osmond, near Adelaide; extent of vineyard, seventeen and a half acres; selling price in bulk f.o.b. at Port Adelaide, 4*s*. per gallon; colour, white; character, sweet; vintage, 1882; name of grape from which wine is made, Madeira; age of vines, twenty-seven years; nature of soil, dark soil with stony sub-soil; elevation, 1200 ft. above sea-level; how cultivated, spur-pruned; number of acres of grapes from which this wine is made, five; number of gallons manufactured last vintage, 400 gallons; of Madeira type. (2) Port wine; selling price in bulk, 4*s*. per gallon; colour, dark red; character, full-bodied; vintage, 1880 and 1881 blended; names of grapes from which wine is made, Shiraz, Mataro, Black Portugal, and Caryguane; age of vines, twenty-seven years; nature of soil, dark clay; elevation, 1200 ft.; how cultivated, rod-pruned; number of acres of grapes from which this wine is made, six; number of gallons manufactured last vintage, 600; of Port type. (3) Dry Sherry wine; selling price in bulk, 4*s*. per gallon; colour, white; character, full-bodied, dry; vintage, 1880; names of grapes from which wine is made, Gouais, Verdeilho, Tokay, and Doradilla; age of vines, twenty-seven years; nature of soil, dark clayey soil, stony sub-soil; elevation, 1200 ft.; how cultivated, spur-pruned; number of acres of grapes from which this wine is made, two; number of gallons manufactured last vintage, 600; of Sherry type. (4) Burgundy wine; selling price in bulk, 4*s*. per gallon; colour, dark red; character, full-bodied, dry; vintage, 1880; name of grape from which wine is made, Shiraz; nature of soil, dark soil, clayey sub-soil; elevation, 1200 ft.; how cultivated, rod-pruned; number of acres of grapes from which this wine is made, five and a half; number of gallons manufactured last vintage, 600 gallons; of Burgundy type.

6. GILBERT, WILLIAM, Pewsey Vale.—(1) Riesling wine; name of vineyard, Pewsey Vale; extent, twenty-eight acres; selling price in bulk f.o.b. at Port Adelaide, 4*s*. per gallon; colour, white; character, light, about 18 per cent.; vintage, 1878 and 1879; name of grape from which wine is made, Riesling; age of vines, from five to thirty

years; nature of soil, sand and gravel; elevation, 1500 ft. above sea-level; how cultivated, trellised; number of gallons manufactured last vintage, 10,000. Exhibitor states—"I could ship 10,000 gallons of wine, half white and half red, annually, and guarantee a uniform sample of light white, ditto light red, containing about 18 per cent. of natural alcohol; no spirit ever added; of Hock type." (2) Carbinet wine; selling price in bulk, 4*s.* per gallon f.o.b., in 1000-gallon lots; colour, red; character, light; about 18 per cent.; vintage, about 1879 and 1880; names of grapes from which wine is made, Carbinet and Shiraz; number of gallons manufactured last vintage, 10,000 gallons; of Claret type.

7. HARDY, THOMAS, Adelaide.—(1) Oomoo Red; selling price in bulk f.o.b. at Port Adelaide, 6*s.* per gallon; colour, red; character, light; vintage, 1882; names of grapes from which this wine is made, Carbinet and Shiraz; of Burgundy type. (2) Tintara Red; name of vineyard, Tintara; extent, 500 acres; selling price f.o.b., 3*s.* per gallon; colour, red; character, light; vintage, 1884; name of grape from which this wine is made, Mataro; age of vines, twenty-one years; nature of soil, ironstone hills and calcareous sub-soil, eastern aspect; 600 ft. above sea-level; number of acres of grapes from which this wine is made, 200; how cultivated, ploughed and scarified; number of gallons manufactured last vintage, 18,000; of Burgundy type. (3) Carbinet; name of vineyards, Tintara and others; selling price f.o.b., 6*s.* per gallon; colour, red; character, light; vintage, 1876; name of grape from which this wine is made, Carbinet; number of gallons manufactured last vintage, 2000; of Claret type. (4) Doradilla; name of vineyard, Tintara; selling price f.o.b., 5*s.* per gallon; colour, white; character, light; vintage, 1884; name of grape from which this wine is made, Doradilla; age of vines, twenty-one years; number of gallons manufactured last vintage, 8000; of Chablis type. (5) Riesling; name of vineyard, Wangolere; selling price f.o.b., 7*s.* per gallon; colour, white; character, light; vintage, 1882; name of grape from which this wine is made, Riesling; of Hock type. (6) Sherry; name of vineyard, Angaston; selling price f.o.b., 6*s.* per gallon; colour, white; character, full-bodied; vintage, 1880; name of grape from which this wine is made, Sherry; nature of soil, sandy loam, calcareous sub-soil; how cultivated, ploughed and scarified; number of gallons manufactured last vintage, 4000 gallons; of Sherry type. (7) Verdeilho; name of vineyard, Bankside; extent, sixty acres; selling price f.o.b., 7*s.* 6*d.* per gallon; colour, white; character, sweet; vintage, 1880; name of grape from which this wine is made, Verdeilho; age of vines, twenty-five years; nature of soil, alluvial; how cultivated, trellised, ploughed, and scarified; number of gallons manufactured last vintage, 2000; of Madeira type. (8) Shiraz; name of vineyard, Bankside; selling price f.o.b., 5*s.* per gallon; colour, red; character, sweet; vintage, 1883; name of grape from which this wine is made, Shiraz; number of gallons manufactured last vintage, 10,000; of Port type. (9) Sauvignon Blanc; name of vineyard, Tintara; extent, 500 acres; selling price f.o.b., 7*s.* 6*d.* per gallon; colour, white; character, full-bodied; vintage, 1883; name of grape from which this wine is made, Sauvignon Blanc; number of gallons manufactured last vintage, 800 gallons; of Sauterne type. (10) Tintara Red; name of vineyard, Tintara; selling price f.o.b., 5*s.* per gallon; colour, red; character, full-bodied; vintage, 1879; name of grape from which this wine is made, Mataro; of Burgundy type. (11) Port; name of vineyard, Angaston; extent, 100 acres; selling price f.o.b., 6*s.* per gallon; colour, red; character, full-bodied; vintage, 1880; name of grape from which this wine is made, Shiraz; number of gallons manufactured last vintage, 3000 gallons; of Port type. (12) No. 1 Claret; name of vineyard, Tintara and other; selling price f.o.b., 5*s.* per gallon; colour, red; character, light; vintage, 1882; number of gallons manufactured last vintage, 10,000 gallons; of Claret type. (13) Tintara Red; name of vineyard, Tintara; selling price f.o.b., 3*s.* per gallon; colour red; character, light; vintage, 1883; names of grapes from which this wine is made, Mataro and Shiraz; number of gallons manufactured last vintage, 15,000; of Burgundy type. (14) Doradilla; name of vineyard, Tintara; selling price f.o.b., 5*s.* per gallon; colour white; character, light; vintage, 1883; name of grape from which this wine is made, Doradilla; number of gallons manufactured last vintage, 5000 gallons; of Chablis type. (15) Shiraz; name of vineyard, Bankside; selling price, 5*s.* per gallon; colour red; character, sweet; vintage, 1883; name of grape from which this wine is made, Shiraz; number of gallons manufactured last vintage, 10,000; of Port type.

8. HAY, HON. ALEXANDER, M.L.C., Linden, near Adelaide.—(1) Linden Tokay; name of vineyard, Linden; extent, nine acres; colour, white; character, full-bodied; vintage, 1878; name of grape from which wine is made, Tokay; age of vines, twenty-four years; nature of soil, marly and stony; aspect, north and west; elevation, 300 ft.;

how cultivated, ploughed, harrowed, and hoed; number of acres of grapes from which this wine is made, two; number of gallons made last vintage, 700 ["I do not make wine every year, nor for sale; I make what I want for use and for friends. Some years I sell the whole of the grapes."]; of Sherry type. (2) Linden Tokay; vintage, 1883; Sherry type. (3) Linden Red; vintage, 1880; colour, red; character, full-bodied; names of grapes from which this wine is made, Grenache, Mataro, and Caryguane; age of vines, twenty-four years; number of acres of grapes from which this wine is made, five ["No wine made last vintage, grapes all sold for wine-making."]; of Port type. (4) Linden Claret; vintage, 1884; colour, red; character, light; names of grapes from which this wine is made, Grenache, Mataro, and Caryguane; number of acres of grapes from which this wine is made, a portion of the produce of five acres; of Claret type.

9. JACOB, WILLIAM, Moorooroo.—(1) Riesling wine; name of vineyard, Moorooroo; extent, sixty-five acres; colour, white; character, dry; vintage, 1879; name of grape from which wine is made, Riesling; age of vines, twenty-four years; nature of soil, calcareous loam; aspect, southern and eastern, slight rises; how cultivated, ploughed and trellised; number of gallons manufactured last vintage, 10,000; of Hock type. (2) Verdeilho wine; colour, white; character, sweet; vintage, 1879; name of grape from which wine is made, Verdeilho; age of vines, twenty-four years; other particulars as above; of Madeira type. (3) Red wine; colour, red; character, dry; vintage, 1880; names of grapes from which wine is made, Carbinet and Shiraz; age of vines, twenty-four years; other particulars as above; of Port type. (4) One case, containing two bottles Riesling, 1865; two bottles Riesling, 1869; two bottles Spanish, 1867; three bottles Carbinet, 1873; two bottles Verdeilho, 1873; and one bottle Verdeilho, 1869 (special assortment); the produce of Moorooroo vineyard.

10. PENFOLD & Co., Magill, near Adelaide.—(1) Frontignac wine; name of vineyard, The Grange; extent, 105 acres; selling price in bottle f.o.b. at Port Adelaide, 24*s.* (quarts), 27*s.* (pints); colour, red; character, full-bodied, sweet; vintages, 1876, 1881, and 1882; names of grapes from which wine is made, Frontignac, Madeira, and Grenache; age of vines, twenty-five years; nature of soil, rich chocolate loam, fifteen miles from sea-coast, at foot of hills; elevation, 400 ft.; how cultivated, plough and hand; number of acres of grapes from which this wine is made, twenty, and grapes purchased; number of gallons manufactured last vintage, 8000; of Constantia type. (2) Frontignac wine; selling price as above, 7*s.* per gallon, 21*s.* (quarts), 24*s.* (pints); vintages, 1882 and 1883; names of grapes from which this wine is made, Grenache, Madeira, Frontignac, and Temprano; of Constantia type. (3) Muscadine; selling price in bottle f.o.b. at Port Adelaide, 24*s.* per case of one dozen; colour, white; character, full-bodied, sweet; vintages, 1881 and 1882; names of grapes from which wine is made, Muscat and Pedro Ximenes; number of acres of grapes from which this wine is made, ten, and produce of other vineyards; number of gallons manufactured last vintage, 8000; of Constantia type. (4) Muscadine wine; selling price, 7*s.* per gallon, 21*s.* (quarts), 24*s.* (pints); vintages, 1882, 1883, and 1884; of Constantia type. (5) Grange Tawney; selling price, 42*s.* (quarts), 45*s.* (pints); colour, tawney; character, sweet, full-bodied; vintages, 1870 to 1875; names of grapes from which wine is made, Madeira, Frontignac, and Grenache; number of acres of grapes from which this wine is made, ten; number of gallons manufactured last vintage, 1000; of Sherry type. (6) Port wine; selling price, 28*s.* (quarts); colour, red; character, full-bodied; vintages, 1876 to 1878; names of grapes from which wine is made, Grenache, Shiraz, and Frontignac; number of acres of grapes from which this wine is made, twenty, and produce of other vineyards; number of gallons manufactured last vintage, 10,000; of Port type. (7) Constantia wine; selling price, 20*s.* (quarts), 23*s.* (pints); colour, red; character, full-bodied; vintages, 1879 and 1881; names of grapes from which this wine is made, Frontignac and Shiraz; number of acres of grapes from which this wine is made, thirty, and produce of other vineyards; number of gallons manufactured last vintage, 10,000; of Constantia type. (8) Constantia wine; selling price, 5*s.* 6*d.* per gallon, 17*s.* (quarts), 20*s.* (pints); colour, red; character, full-bodied, medium, sweet; vintages, 1882 and 1883; names of grapes from which this wine is made, Frontignac and Shiraz; number of acres of grapes from which this wine is made, thirty acres, and produce of other vineyards; number of gallons manufactured last vintage, 10,000; of Constantia type. (9) Grenache wine; selling price, 20*s.* (quarts), 23*s.* (pints); colour, red; character, full-bodied; vintages, 1876 to 1881; names of grapes from which this wine is made, Mataro and Grenache; number of acres of grapes from which this wine is made, thirty, and produce of other vineyards; number of gallons manufactured last vintage, 10,000; of Port type. (10) Grenache

wine; selling price, 5*s.* 6*d.* per gallon, 17*s.* (quarts), 20*s.* (pints); vintages, 1882 and 1883; nature of soil, &c., chocolate loam, at foot of hills, facing north-west and south; of Port type. (11) Carbinet wine; selling price, 17*s.* (quarts), 20*s.* (pints); colour, red; character, dry; vintage, 1881; names of grapes, Shiraz and Carbinet; number of acres of grapes, ten, and produce of other vineyards; number of gallons manufactured last vintage, 10,000; of Burgundy type. (12) Carbinet wine; selling price, 16*s.* (quarts), 19*s.* (pints); vintages, 1881 and 1882; of Burgundy type. (13) Carbinet wine; selling price, 4*s.* 6*d.* per gallon, 15*s.* (quarts), 18*s.* (pints); character, dry, light-bodied; vintages, 1882 and 1883; of Burgundy type. (14) Riesling wine; selling price, 15*s.* (quarts), 18*s.* (pints); colour, light white; character, dry, light; vintages, 1882 and 1883; name of grape, Riesling; number of acres of grapes from which this wine is made, ten; number of gallons manufactured last vintage, 3000; of Hock type. (15) Riesling wine; selling price, 17*s.* (quarts), 20*s.* (pints); colour, white; character, light dry; vintages, 1881 and 1882; name of grape, Riesling; of Hock type. (16) Tokay wine; selling price, 5*s.* 6*d.* per gallon, 17*s.* (quarts), 20*s.* (pints); colour, white; character, full-bodied medium Hock; vintages, 1882, 1883, and 1884; names of grapes, Tokay, Temprano, and Pedro Ximenes; number of acres of grapes, twenty; number of gallons manufactured last vintage, 10,000; of Chablis type. (17) Tokay wine; selling price, 18*s.* (quarts), 21*s.* (pints); colour, white; character, full-bodied; vintages, 1881 and 1882; names of grapes, Tokay, Temprano, and Pedro Ximenes; number of acres of vines, twenty; number of gallons of this wine manufactured last vintage, 10,000; of Chablis type. (18) Tokay wine; selling price, 20*s.* (quarts), 23*s.* (pints); colour, white; character, full-bodied; vintages, 1880 and 1881; names of grapes, Tokay, Temprano, and Pedro Ximenes; of Chablis type. (19) Pedro Ximenes wine; selling price, 17*s.* (quarts), 20*s.* (pints); colour, white; character, full-bodied, medium dry; vintages, 1882 to 1884; name of grape, Pedro Ximenes; number of acres of grapes, twenty; number of gallons manufactured last vintage, 8000; of Sherry type. (20) Pedro Ximenes wine; vintages, 1881 and 1882; character, dry, full-bodied; of Sherry type.

11. Ross, Hon. R. D., M.P., Highercombe.—(1) Red wine; name of vineyard, Highercombe (Highercombe is the oldest vineyard in the Colony, planted upwards of forty-five years); colour, red; character, full-bodied; nature of soil, loamy with lime and iron; vintage, 1862; elevation, 1500 ft. Wines sent from this vineyard, from 1862 to 1883, are forwarded to illustrate the improvement in manufacture. (2) Sherry; white; full-bodied; 1866; of Sherry type. (3) Frontignac; white; full-bodied; 1867; of Constantia type. (4) Sherry; white; full-bodied; 1867; of Sherry type. (5) Sherry; white; full-bodied; 1868; of Sherry type. (6) Funchal; white; full-bodied; 1869; of Madeira type. (7) Burgundy; red; full-bodied; 1869; of Bordeaux type. (8) Burgundy; red; full-bodied; 1870; of Bordeaux type. (9) White; white; light; 1875; of Chablis type. (10) Claret; red; light; 1883; of Claret type. (11) Hermitage; red; light; 1883; of Hermitage type. (12) Amber; white; light; 1883; of Chablis type. (13) Sherry; white; full-bodied; 1883; of Sherry type.

12. Salter, W., & Son, Angaston.—(1) Dry Sherry wine; name of vineyard, Saltram, near Angaston; extent, eighty acres; colour, white; character, full-bodied; vintage, 1879; name of grape from which wine is made, Sherry; age of vines, fifteen years; nature of soil, sandy loam; how cultivated, ploughed and scarified with horses; number of acres of grapes from which this wine is made, thirty; number of gallons manufactured last vintage, 19,000; of Sherry type. (2) Shiraz wine; colour, red; character, full-bodied; vintage, principally 1868; name of grape from which wine is made, Shiraz; age of vines, thirty years and older; number of acres of grapes from which this wine is made, thirty; number of gallons manufactured last vintage, 19,000; of Port type. (3) Sweet Sherry wine; colour, white; character, full-bodied; vintages, 1876 and 1878; names of grapes from which wine is made, Sherry and other grapes; number of acres of grapes from which this wine is made, thirty; number of gallons manufactured last vintage, 19,000; of Sherry type. (4) S.A. Port wine; colour, red; character, full-bodied; vintage, 1879; name of grape from which wine is made, Shiraz; number of acres of grapes from which this wine is made, thirty; number of gallons manufactured last vintage, 19,000; of Port type. (5) Dry Shiraz wine; colour, red; character, full-bodied, dry; vintage, 1879; name of grape from which wine is made, Shiraz; number of acres of grapes from which this wine is made, thirty; number of gallons manufactured last vintage, 19,000; of Burgundy type. (6) Shiraz wine; colour, red; character, full-bodied; vintage, 1879 and older; name of grape from which wine is made, Shiraz; number of acres of grapes from which this wine is made, thirty; number of gallons manufactured last vintage, 19,000; of Port type.

13. SEPPELT, B., Seppeltsfield, Greenock.—(1) Mataro; name of vineyard, Seppeltsfield; selling price f.o.b., 2*s.* 6*d.* per gallon; colour, red; character, light; vintage, 1883; nature of soil, light character, mixed with small quantity of lime, light loose clay sub-soil; elevation, 900 ft.; how cultivated, short-pruned, and grown as bushes ten feet each way; of Claret type. (2) Sweet Mataro; selling price f.o.b., 4*s.* per gallon; colour, red; character, full-bodied; vintage, 1883; of Port type. (3) Seppeltsfield Red; selling price, 4*s.* per gallon; colour, red; character, full-bodied; vintage, 1884; of Port type. (4) Claret; selling price f.o.b., 3*s.* per gallon; colour, red; character, light; vintage, 1881; of Claret type. (5) Blanquette; selling price f.o.b., 2*s.* 6*d.* per gallon; colour, white; character, light, dry; vintage, 1882; of Chablis type. (6) Seppeltsfield White; selling price f.o.b., 3*s.* per gallon; colour, white; character, light; vintage, 1882; of Chablis type. (7) Riesling; selling price f.o.b., 4*s.* per gallon; colour, white; character, light; vintage, 1882; of Hock type. (8) Sherry; selling price f.o.b., 5*s.* per gallon; colour, white; character, full-bodied, sweet; vintage, 1881; of Sherry type. (9) Port; selling price f.o.b., 4*s.* per gallon; colour, red; character, full-bodied, sweet; vintage, 1882; of Port type. (10) Frontignac; selling price f.o.b., 5*s.* per gallon; colour, white; character, full-bodied, sweet; vintage, 1881; of Constantia type.

14. SMITH, S., & SON, Angaston. — (1) Frontignac wine; name of vineyard, Yalumba; selling price in bulk f.o.b. at Port Adelaide, 4*s.* per gallon; colour, white; character, light; vintage, 1882; names of grapes from which wine is made, Frontignac and other good kinds; age of vines, twenty-five years; nature of soil, sandy loam; how cultivated, ploughed; number of gallons manufactured last vintage, 6000; of Constantia type. (2) Ruby wine; selling price in bulk, 6*s.* per gallon; colour, ruby; character, sweet; vintage, 1882; name of grape from which wine is made, Shiraz; age of vines, twenty-five to thirty years; nature of soil, red soil and limestone; of Port type. (3) Muscat wine; selling price in bulk, 6*s.* per gallon; colour, white; character, sweet; vintage, 1882; name of grape from which wine is made, Muscatel; age of vines, twenty years; nature of soil, sandy; number of gallons manufactured last vintage, 6000; of Constantia type. (4) Sherry wine; selling price in bulk, 5*s.* per gallon; colour, light; character, light; vintage, 1882; name of grape from which wine is made, not known; ages of vines, some twenty years, some ten years; nature of soil, sandy (a large quantity of grapes are bought); number of acres of grapes from which this wine is made, fifty to sixty; many thousand gallons manufactured last vintage; of Sherry type. (5) Port wine; selling price in bulk, 6*s.* per gallon; colour, red; character, full; vintage, 1882; name of grape from which wine is made, Shiraz; age of vines, thirty years; number of gallons manufactured last vintage, 12,000; of Port type. (6) Port wine; vintage, 1882; of Port type. (7) Frontignac wine; vintage, 1882; of Constantia type. (8) Ruby wine; vintage, 1882; of Port type. (9) Muscat wine; vintage, 1882; of Constantia type. (10) Sherry wine; vintage, 1882; of Sherry type. (11) Port wine; vintage, 1876; of Port type.

15. WIGG, R. H., & SONS, King William Street, Adelaide.—(1) S.A. Port; selling price f.o.b., 35*s.* per dozen; colour, red; character, sweet; vintage, 1876; blended wine; of Port type. (2) Old Constantia; selling price, 40*s.*; colour, red; character, sweet; vintage, 1868; blended; of Constantia type. (3) Constantia; selling price, 30*s.*; colour, red; character, sweet; vintage, 1877; blended; of Constantia type. (4) S.A. Sherry; selling price, 35*s.*; colour, white; character, sweet; vintage, 1876; blended; of Sherry type. (5) Tokay; selling price, 25*s.*; colour, white; character, sweet; vintage, 1878; blended; of Chablis type. (6) Frontignac; selling price, 30*s.*; colour, white; character, sweet; vintage, 1878; blended; of Constantia type.

16. WRIGHT, EDMUND W., Home Park Vineyard, Magill.—(1) Pedro wine; extent of vineyard, forty acres; selling price, in bulk or bottle, f.o.b. at Port Adelaide, 10*s.* per gallon, or 25*s.* per dozen; colour, straw; character, light; vintage, 1882; name of grapes from which wine is made, Pedro Ximenes; age of vines, twenty years; nature of soil, gravelly and clay bottom; elevation, 400 ft. above the sea; how cultivated, pruned, ploughed, and scarified; number of acres of grapes from which this wine is made, five; 1200 gallons of this wine manufactured last vintage; of Sherry type. (2) Frontignac wine; selling price, 10*s.* per gallon, or 25*s.* per dozen; colour, light red; character, full-bodied, sweet; vintage, 1882; names of grapes from which wine is made, Frontignac and Muscatel; nature of soil, red ferruginous clay; number of acres of grapes from which this wine is made, ten; number of gallons manufactured last vintage, 2000; of Constantia type. (3) Shiraz wine; selling price, 10*s.* per gallon, or 25*s.* per dozen; colour, red; character, full-bodied; vintage, 1882; name of grape from which wine is

made, Shiraz; age of vines, twenty years; nature of soil, red ferruginous clay, western aspect; number of acres of grapes from which this wine is made, six; number of gallons manufactured last vintage, 1000; of Port type. (4) Port wine; selling price, 10*s.* per gallon, and 25*s.* per dozen; colour, red; character, full-bodied; vintage, 1882; names of grapes from which this wine is made, Shiraz and Mataro; age of vines, twenty years; nature of soil, red ferruginous clay; western aspect; number of acres of grapes from which this wine is made, ten; number of gallons manufactured last vintage, 2000; of Port type. (5) Burgundy wine; selling price, 11*s.* per gallon, and 27*s.* 6*d.* per dozen; colour, red; character, full-bodied; vintage, 1875; name of grape from which this wine is made, Shiraz; number of acres of grapes from which this wine is made, eight; number of gallons manufactured last vintage, 2000; of Burgundy type.

17. YOUNG, C. B., Adelaide.—(1) Red wine; name of vineyard, Kanmantoo; extent, thirty-five acres; selling price, 2*s.* 9*d.* per gallon, and 10*s.* per dozen; colour, red; character, medium; vintage, 1880; names of grapes from which wine is made, Shiraz, Mataro, and Grenache; age of vines, various; nature of soil, sandy loam, with marly sub-soil; how cultivated, standard vines, 8 ft. apart, Shiraz trellised; number of acres of grapes from which this wine is made, thirty-five; number of gallons manufactured last vintage, 6000; of Port type. (2) Red wine; selling price, 3*s.* per gallon; colour, red; character, full-bodied; vintage, 1884; names of grapes from which wine is made, Shiraz and Mataro; number of gallons manufactured last vintage, about 2000; of Port type.

QUEENSLAND.

Wines.

1. BASSET, S. S., Roma.—(1) Sherry, in case, 3 years old. (2) Hermitage. (3) Burgundy. (4) Reisling. (5) Sherry, in bottle.

2. BEH, DAVID, Summithill Vineyard, Toowoomba.—(1) White light table wine, "Shepherd's Reisling." Age of vine, 5 years; trained on vine sticks; vintage, March, 1885; soil, red volcanic, trenched 2 feet deep. (2) Red table wine, from Black Spanish and Isabella vines—mixed. Age of vine, 6 years; trained on vine sticks; vintage, March, 1885; soil, red volcanic, trenched 2 feet deep.

3. BENSLEY, MARK, Grange Farm Vineyard, Rosewood, Ipswich.—(1) Light dry "Red Salvino." Age of vine, 2 years; soil, chocolate; hand-cultivated on trellis; vintage, 1880. (2) Full-bodied sweet wine, "Red Hermitage." Age of vine, 3 years; hand-cultivated on trellis; vintage, 1880; soil, chocolate.

4. BISHOP, D. S., Newtown Vineyard, Southport. — Sweet red wine, from "Isabella" grape. Age of vine, 6 years; hand-trained on wire; northern aspect; vintage, 1882; soil, red loamy clay.

5. CHUBB, CHARLES F., & Co., Malmesbury Vineyard, Ipswich. — Dry Red "Malmesbury." Age of vine, 4 years. Espar vine, trained by hand on trellis on three wires strained; vintage, 1879; soil, alluvial black, with limestone.

6. DICK, JAMES, Reside Vineyard, Ipswich.—(1) Red wine, "Reside." Espar vine. Age of vine, 6 years; cultivated by horse and hand labour, and trained on trellis and three wires; vintage, 1883; soil, brown loam. (2) Sweet white wine, "Reside." White Shiraz and White Ulis vine. Age of vine, 4 years; cultivated by horse and hand labour, and trained on trellis and three wires; vintage, 1883; soil, brown loam.

7. HERZER, HENRY, Saxony Gardens, Toowoomba.—(1) White light table wine, "Salvino." Age of vine, 4 years; cultivated by hand, on stakes; vintage, 1883; soil, heavy red. (2) Table wine, "Red Spanish." Black Spanish vine; age of vine, 3 years; cultivated by hand on stakes; vintage, 1882; soil, heavy red.

8. IRWIN BROTHERS, Warrilla Vineyard, Ipswich.—(1) White wine, "Verdeilho." Age of vine, 12 years; cultivated by horse and hand labour, and trained on wire trellises; vintage, February, 1883; soil, clay, with nodules of magnesian limestone. (2) Red wine, "Mataro." Age of vine, 12 years; cultivated by hand and horse labour, and trained on wire trellises; vintage, 1883; soil, clay, with nodules of magnesian limestone.

9. KIEHM, HENRY, Ruthven Vineyard, Toowoomba. — (1) Red full table wine, from Black Spanish and Isabella grapes. Age of vine, 5 years; trenched 2 feet deep, and trained on single stakes; vintage, February, 1885; soil, red volcanic—iron gravel. (2) Full table wine, from Black Spanish and Isabella grapes. Age of vine, 5 years; trenched 2 feet deep, trained on single stakes; vintage, February, 1885; soil, iron gravel (red volcanic).

10. KIRCHER, JACOB, Assmanshausen Vineyard, Warwick.—(1) Red "Hermitage."

Age of vine, 12 years; cultivated by plough and horse-hoe, and trained on wire trellis; vintage, 1879; soil, loamy gravel. (2) White "Verdeilho." Age of vine, 12 years; cultivated by plough and horse-hoe, and trained on wire trellis; vintage, 1879; soil, loamy gravel. (3) Red "Hermitage." Age of vine, 12 years; cultivated by plough and horse-hoe, and trained on wire trellis; vintage, 1884; soil, loamy gravel. (4) White "Verdeilho." Age of vine, 12 years; cultivated by plough and horse-hoe, and trained on wire trellis; vintage, 1884; soil, loamy gravel.

11. LAMBERT, G., Mount Walker, Ipswich.—(1) Black "Hermitage," full-bodied wine. Age of vine, 6 years; cultivated by horse labour, and trained on its own stalks; vintage, 1884; soil, black limestone. (2) White "Hermitage." Age of vine, 7 years; cultivated by hand, and trained on trellises; vintage, 1883; soil, gravel.

12. LE GRAND, ROBERT W., Wooyumboong Vineyard, Ipswich.—(1) Dry wine, "White Sherry." Age of vine, 6 years; trenched by hand, and trained on wires; vintage, 1885; soil, light loamy clay, and stony; brand, L in diamond. (2) Sweet White "Hermitage." Age of vine, 7 years; trenched by hand, and laboured by horse-power, and trained on three horizontal wires; vintage, 1885; soil, light loam, yellow clay, and broken rock. (3) Dry Red Wine; vintage, 1883.

WESTERN AUSTRALIA.

Wines.

1. EASTON, W., Windsor Vineyard, Swan River, near Freemantle—about 14 acres; alluvial sand, in deep limestone basin. Red wine; vintage, 1881; made from Red Madeira; planted in 1864. Hock; vintage, 1880; made from grapes locally known as "White Hambro;" planted in 1864. Burgundy; vintage, 1882; made from grapes locally known as "Miller's Burgundy;" planted in 1864; vines principally tied to framework.

2. JECKS, THOMAS, Guildford. — Houghton white wine, 1883; made from "Verdeilho" grapes, by C. W. Ferguson, Houghton vineyard; 14 acres: red sandy loam; standard vines. Caversham red wine, 1882; made from "Muscatel" and "Shaw's Green," by Mrs. De Burgh, Caversham vineyard; stiff clay; standard vines. Fontainbleau, 1884; made from "Fontainbleau" grapes, by C. W. Ferguson, Houghton vineyards (as above).

3. WAYLEN, A. R., M.D., Garden Hill, Guildford—about 9 acres; heavy loam; north-east aspect; vines trained to low espaliers. Cost of cultivation per acre, £10. "Reisling;" dry, light; vintage, 1883; made from Sweetwater and Reisling. Garden Hill white wine; vintage, 1884; made from Sweetwater, Reisling, and Pedro Ximenes. Fontainbleau; red wine; full-bodied; vintage, 1881; made from a species of Burgundy; planted in 1859. Burgundy; red wine; full-bodied, dry; vintage, 1879; made from "Miller's Burgundy;" planted in 1861.

4. HERBERT, J. A., Rockingham Vineyard, Freemantle—2½ acres; sandy soil; northerly aspect; trellis vines. White wine; made from mixed grapes; vintage, 1883.

5. FAUNTLEROY, C. C., Redcliffe Vineyard, Guildford—2½ acres; fine sand on yellow clay. Cost of cultivation per acre, £5 10s. "Sweetwater;" full-bodied, dry; made from Sweetwater; planted in 1835; bush vines.

6. HASSELL, A. & A., Kendennup—1 acre; soil, clay. Cost of cultivation per acre, £10. Reisling; vintage, 1878.

7. CLINCH, J., Berkshire Valley—1 acre; soil, light loam. Cost of cultivation per acre, £30. Wine; vintage, 1884. Wine; vintage, 1878.

NEW ZEALAND.

Wines.

SOLER, JOSEPH, Grancanonger Vineyard, Wangauni.—Assorted wines, manufactured from grapes: Hock, Mansanille Sherry, Red Constantia No. 2, Light Constantia No. 1, Verdeilho, Chisella, Port, Muscat, Malaga, Burgundy, Sparkling Hock, Sparkling Moselle.

Home-made Wines.

BLUNCK, DIEDRICH, Hokitika.—Ginger Wine, Orange Wine, Gooseberry Wine, Black Currant Wine, Red Currant Wine, Parsnip Wine, Elderberry Wine, Rhubarb Wine. These wines are all made of New Zealand fruit, &c.; they are four years old; and the Gooseberry wine possesses a flavour and character of the Champagne type.

CYPRUS.

Wines.

Class.	Description.	Age.	Price F. O. B. in Cyprus.	Duty Payable on Import into England.	Freight to Liverpool approximately.	Total Approximative Cost in England Duty Paid.	Shipper of Sample Exhibited at Tasting Bar.
		Years.					
Sweet	Morocanella	5–10	5*s.* per gallon	1*s.* per gallon	2*d.* per gallon	6*s.* 2*d.* per gallon	G. D. Cacathimi, Limassol, Cyprus.
	Ditto	3	3*s.* ,,	1*s.* ,,	2*d.* ,,	4*s.* 2*d.* ,,	
	Xynisteri	...	5*s.* ,,	1*s.* ,,	2*d.* ,,	6*s.* 2*d.* ,,	G. N. Laniti, Limassol, Cyprus.
	Commanderia	4–10	4*s.* ,,	1*s.* ,,	2*d.* ,,	5*s.* 2*d.* ,,	G. D. Cacathimi, Limassol, Cyprus.
	Ditto	3	2*s.* ,,	1*s.* ,,	2*d.* ,,	3*s.* 2*d.* ,,	
	Ditto	1	1*s.* 6*d.* ,,	1*s.* ,,	2*d.* ,,	2*s.* 8*d.* ,,	
Common	Red Wines	...	1*s.* 10½*d.* ,,	1*s.* ,,	2*d.* ,,	3*s.* 0½*d.* ,,	G. N. Laniti, Limassol, Cyprus.
	Red (special make)	...	9*s.* per dozen	1*s.* ,,	2*s.* per dozen	13*s.* per dozen	N. G. Nicadinos, Larnaca, Cyprus.
	White (special make)	...	6*s.* ,,	1*s.* ,,	2*s.* ,,	10*s.* ,,	
	Black "Chateau Mezzo Campo" (special make)	...	10*s.* per dozen, discount of 30% on orders for 100 dozen	1*s.* ,,	2*s.* ,,	14*s.* per dozen, or 11*s.* per dozen for 100 dozen	J. W. Williamson & Co., Limassol, Cyprus.
	Black Ordinary	1	7*d.* per gallon	1*s.* ,,	2*d.* per gallon	1*s.* 9*d.* per gallon	G. D. Cacathimi, Limassol, Cyprus.

CAPE OF GOOD HOPE.

Wines.

ROUX, P. C. LE; vineyard, Paarl; colour, white; Green Grape, or Natural Sherry; vintage, 1882; selling price, 21*s.* per dozen bottles, and 9*s.* per gallon in wood.

MERWE, P. VAN DER; vineyard, Goudine; colour, white; Stein Grape, or Chablis; vintage, 1884; selling price, 18*s.* per dozen bottles, and 8*s.* per gallon in wood.

KEET, R.; vineyard, Montague; colour, red; Red Muscatel, dry; vintage, 1884; selling price, 18*s.* per dozen bottles, and 8*s.* per gallon in wood.

ROUX, P. C. LE; vineyard, Paarl; colour, white; White Green Grape, or Sauterne; vintage, 1884; selling price, 18*s.* per dozen bottles, and 8*s.* per gallon in wood.

LATEGAN, S. P.; vineyard, Constantia; colour, white; Hanepot, or Hock; vintage, 1884; selling price, 18*s.* per dozen bottles, and 8*s.* per gallon in wood.

KEET, R.; vineyard, Montague; colour, red; Dry Pontac, or Port; vintage, 1884; selling price, 21*s.* per dozen bottles, and 9*s.* per gallon in wood.

BOSMAN, J. D.; vineyard, Paarl; colour, red; Sweet Pontac, or Constantia; vintage, 1883; selling price, 36*s.* per dozen bottles, and 15*s.* per gallon in wood.

BOSMAN, J. D.; vineyard, Paarl; Sweet Frontignac, or Constantia; vintage, 1883; selling price, 36*s.* per dozen bottles, and 15*s.* per gallon in wood.

CANADA.

Wines.

BARRÉ & Co., 188 Fortification Lane, Montreal, Quebec.—Canadian wines, consisting of Port, Sherry, Claret, Sauterne, Vermouth, and Sacramental Wine.

BRIGHT, THOMAS A., Toronto, Ontario.—Wine.

HAMILTON, S. C., & Co., Brantford, Ontario, and the vineyards, Pelee Island.—Wines from grapes of Canadian growth.

ONTARIO GRAPE-GROWING AND WINE-MANUFACTURING COMPANY, St. Catherine's, Welland, Ontario.—Wines from Canadian grapes.

Spirits.

GOODERHAM & WORTS, Toronto, Ontario (established 1832).—Canadian Malt and Rye Whiskies, Pure Spirit.

SEAGRAM, JOSEPH E., Waterloro, Ontario.—Canadian Malt and Rye Whiskies, Pure Spirits, Alcohol.

WALKER, HIRAM, & SONS, Walkerville, Ontario.—Canadian Rye Whiskies, Cologne Spirit.

NEW SOUTH WALES.

Spirits, &c.

COLONIAL SUGAR-REFINING COMPANY, O'Connell Street, Sydney.—Rum, White Spirit.

BARRETT & Co., Sydney.—Cordials and Syrups.

DEAR, R., Tumut.—Raspberry Balm.

HUME & PEGRUM, Sydney.—Cordials.

ONSLOW, MRS. ARTHUR A. W., Camden Park, Menangle.—Lemon Syrup.

WATSON & YOUNG, Albury, Corowa, and Rutherglen.—Cordials.

SOUTH AUSTRALIA.

Spirits, &c.

BARNFIELD, TURNER, & Co., East Adelaide.—Essence of Ratafia, Essence of Almonds, Essence of Lemon, Lime Juice Cordial.

BICKFORD, A. M., & SONS, Currie Street, Adelaide.—Lime Juice Cordial, Raspberry Balm, Ginger Brandy, Ginger Wine, Quinine Wine, Stomach Bitters, Orange Bitters, Curacoa, Hop Bitters, Maraschino Noyeau.

CROWDER & Co., Franklin Street, Adelaide.—Doctor's Bitters, Ginger and Quinine Wines, Cloves, Kümmel, Peppermint, Milk Punch, Lime Juice Cordial, Hop Tonic Bitters, Kent Hop Bitters, Raspberry Balm.

HALL, GEORGE, & SONS, Norwood, near Adelaide.—Lime Juice Cordial, Raspberry Balm, Ginger Wine, Ginger Brandy, Sarsaparilla, Peppermint, Cloves, Quinine Wine, Stomach Bitters, Kent Hop Bitters, Orange Bitters, Tannin Wine.

LADD, J. O., College Park, near Adelaide.—Cordials.

SEPPELT, B., Seppeltsfield.—Spirits of Wine.

SOLOMON, I. S., & Co., Eureka Cordial Factory, Currie Street, Adelaide.—Cordials.

VICTORIA.

Spirits, &c.

ATKEN, C. A., North Melbourne.—Quinine Wine.

DIXON, G. P., & Co., Melbourne.—Cloves, Cinchona Tonic Bitters, Ginger Brandy, Ginger Wine, Kent Hop Bitters, Lime Juice Cordial, Orange Wine, Peppermint, Quinine Wine.

HURST, EDWARD, Beechworth.—Green Ginger Wine, Lime Juice Cordial.

ROWLEY, JOHN S., Warrnambool.—Hop Bitters.

WARRENHEIP DISTILLERY, Mount Warrenheip, Dunnstown.—Whisky, Geneva, Spirits of Wine.

WESTERN AUSTRALIA.

Spirits, &c.

JOSE, W., Geraldton.—Cordials (an assortment of): chiefly Fruit Syrups.

NEW ZEALAND.

Spirits, &c.

THOMSON & Co., Crawford Street, Dunedin.—Lime Juice Cordial, Peppermint Cordial. Lemon Syrup, Cloves, Cherry Brandy, Still Quinine Champagne, Aromatic Bitters (Dark), Ginger Brandy, Ginger Wine, Raspberry Vinegar, Orange Bitters, Pineapple Cordial, Curacao Liqueur, Maraschino Liqueur.

DIXON, MRS. GEORGE, 33 Cuba Street, Wellington.—Cordials: Ginger Wine, Ginger Brandy, Raspberry Vinegar, Sarsaparilla, Lime Juice, Tonic Bitters, Stoughton Bitters, Orange Bitters, Quinine Bitters, Raspberry Syrup, Lemon Syrup, Cloves Syrup, Peppermint Syrup, Pineapple Syrup.

QUEENSLAND.

Spirits, &c.

BAIN, JAMES, Ipswich.—Cordials.

CASTLES, WILLIAM, Loganholme.—Rum.

DAVY & GOODING, Beenleigh.—Rum, 18 months old.

GARDNER, OWEN, Normanby Distillery, near Brisbane.—Rum, in cask and in bottle.

HOOPER, JOHN HENRY, Ipswich.—Cordials.

MELBOURNE-MACKAY SUGAR CO., LIMITED, Alexandra Plantation Distillery, Mackay.—(1) Proof Rum, from Alexandra Plantation. (2) Proof Rum, from Tekowai Plantation.

MILTON DISTILLERY CO., Brisbane.—Rum.

PLEYSTOWE SUGAR CO., Mackay.—Rum, in bottle and in cask.

RAFF, GEORGE, Caboolture.—Plantation Rum, in bottle, distilled in 1875.

CAPE OF GOOD HOPE.

Spirits, &c.

PARKES, JOHN J., Wheatlands.—Brandy.

PAARL WINE & BRANDY CO.—Wine and Spirits.

BOSENBERG, C. H., Capetown.—Aromatic Stomachic Bitters.

CEYLON.

Spirits, &c.

DIAS, ARNOLD.—Arrack.
CEYLON AGRICULTURAL ASSOCIATION.—Arrack.
GOVERNMENT OF CEYLON.—Arrack.
WINTER & SONS.—Rum.

HONG KONG.

Spirit.

CHINA SUGAR-REFINING CO., LIMITED.—Rum.

BRITISH GUIANA.

Spirits, &c.

White Rum.—(1) Plantation Farm. (2) Plantation Herstelling. (3) Plantation L'Union. (4) Plantation Enterprise Leguan. (5) Plantation Enmore. (6) Plantation Success. (7) Plantation Blankenburg. (8) Plantation Hague. (9) Plantation Tuschen de Vrienden. (10) Plantation La Bonne Intention. (11) Plantation Hope. (12) Plantation Houston. (13) Plantation Farm. (14) Plantation Marionville. (15) Plantation Château Margot. (16) S. R. Pontifex. (17) Plantation Cane Grove. (18) Plantation Nismes. (19) Plantation Port Mourant.

Coloured Rum.—(1) Plantation Farm. (2) Plantation Hope. (3) Plantation Houston. (4) Plantation Marionville. (5) Plantation Marionville (logwood). (6) Plantation Herstelling. (7) Plantation L'Union. (8) Plantation Enterprise Leguan. (9) Plantation Enmore. (10) Plantation Success. (11) Plantation Met en Meerzog. (12) Plantation Blankenburg. (13) Plantation Taymouth Manor. (14) Plantation Taymouth Manor (Mango). (15) Plantation Hague. (16) Plantation Caledonia. (17) Plantation Tuschen de Vrienden. (18) Plantation Uitvlugt. (19) Plantation La Bonne Intention. (20 & 21) Plantation Cane Grove. (22) Plantation Château Margot. (23) Plantation Enterprise. (24) Plantation F.M.M. (25) S. R. Pontifex.

Bitters.—(1) W. Fresson. (2) H. T. Matthews. (3) C. F. Viera. (4) Plantation Hope. (5) S. R. Pontifex.

Rum Shrub.—(1) Plantation La Bonne Intention. (2) S. R. Pontifex. (3) R. G. Greaves.

JAMAICA.

Spirits, &c.

Rum.—During the year 1885, Jamaica rum was exported to the extent of 2,080,471 gallons, of the value of £234,053. This industry occupies so prominent a position and is so widely known that it is needless to enlarge upon it. The exhibits include the finest and best brands produced in the island, and embrace estates and merchant's rums of acknowledged excellence.

GORDON, C. H. W.—(a) Lancaster Estate, crop 1885; (b) Brace, crop 1885.

SEWELL, HENRY.—(a) Hyde, crop 1885; (b) Steelfield, crop 1885; (c) Vale Royal, crop 1885; (d) Lottery, crop 1885, crop 1882.

BARRETT, C. J. M.—Oxford, crop 1885.

THOMPSON, MRS. E.—Cambridge, crop 1885.

RONALDSON, H. T.—(a) Lodge (white) and , crop 1885; (b) Lodge (white) , crop 1885; (c) Lodge , crop 1886; (d) Lodge (white) , crop 1885.

GENTLES, A. B.—Chester , crop 1885.

GORDON, J. W.—Georgia , crop 1885.

STEWART, C. H.—Fontabella , crop 1885.

PROCTOR, DR.—(a) Brampton Bryan , crop 1885; (b) Bryan Castle crop, 1885.

STIEBEL, GEORGE.—Lloyd's , crop 1885.

STERLING, C. N.—Content $\frac{L}{A.E}$, crop 1885.

KEMP, JAMES W.—Savoy $\frac{S}{WW}$, crop 1886.

OGILVY, WALTER.—(a) Spring Estate $\frac{S}{RM}$, crop 1885; (b) Hopewell $\frac{H}{I \diamond C}$, crop 1885; (c) Hopewell (white) $\frac{H}{I \diamond C}$, crop 1885.

HARRISON, JAMES.—(a) Hordley HM, crop 1885; (b) Amity Hall $\frac{A}{T.C.}$, crop 1885; (c) Hordley HM, crop 1864.

MCPHAIL, J.—(a) Tulloch (white) $\frac{T}{FG}$, crop 1886; (b) Tulloch $\frac{T}{FG}$, crop 1886; (c) Knollis $\frac{K}{\text{Æ}F}$, crop 1885.

TRELEAVEN, C. W.—(a) Y. S., crop 1886; (b) Ipswich $\overline{\text{IP}}$, crop 1886; (c) Bogue $\frac{D}{WF}$, crop 1886; (d) YS P, crop 1886.

EVES, C. W., & Co.—(a) Friendship, crops 1862 to 1886 (1867 white); (b) E◇G, crop 1886.

LUSHINGTON, COLONEL L. F.—Cornwall L^c, crop 1886.

KING, EUSTACE.—(a) Blackheath $\frac{W}{B}$, crop 1886; (b) Blue Castle E.W.O, crop 1886.

HEAVEN, DR. B. S.—Golden Grove GG, crop 1886.

RONALDSON, J. J.—Halse Hall $\frac{IM}{BY}$, crop 1886.

WARD, C. I.—(a) Money Musk $\frac{M}{R \diamond S}$, crop 1885; (b) Greenwich $\frac{G}{B \diamond D}$, crop 1885.

TALBOT, COLONEL.—Worthy Park LP, crop 1886.

VERLEY, LOUIS.—(a) $\frac{M}{LV}$, crop 1885; (b) $\frac{V}{PB}$ (white), crop 1885; (c) $\frac{M}{LV}$, crop 1885 (white).

FARQUHARSON, J. M.—(a) Merchant Rum Ⓔ, crop 1885; (b) Merchant Rum Ⓔ, crop 1875.

FINZI, D., & Co.—One, five, ten, fifteen, twenty, and thirty-one years old Rum.

WRAY & NEPHEW.—Ten, fifteen, and twenty-five years old Rum.

DESNOES, P., & SON.—Very old Rum; White Rum, 18 per cent.; Old Rum.

SIMPSON-CARSON, MAJOR J.—Rum $\frac{RH}{A}$ and A^c.

PLUMMERS' F◇G.—Crops 1863 to 1885.

HAWTHORN, SHEDDER & Co.—$\frac{P}{I \diamond W}$, crop 1885; crop 1882, "Estate" Rum.

WEDDERBURN.—Crops 1863 to 1886.

SIMON & LERAY.—White and Coloured Rum, 35 over proof.

CLARKE, G. ROCHFORT.—Swanswick $\frac{C}{GRC}$.

SHIRLEY, L. C.—(a) Ettingdon Estate, crop 1886; (b) Hyde Hall, crop 1886.

KER, W.—(a) Kent Estate; (b) Gales Valley; (c) Telston; (d) Golden Grove; (e) Wiltshire Estate; (f) Orange Valley (10 years old); (g) Orange Valley; (h) Catherine Hall; (i) Guilsbro; (k) Round Hill; (l) Dundee.

ROBINSON, C. A.—(a) Cherry Garden; (b) Cherry Garden (white).

SIMON & LERAY.—White Rum.

HOUCHEN, A. C.—White Rum.

STEWART, A.—White Rum.

SADLER, E. J.—"Estate" Rum.

TAYLOR, A. W.—"Estate" Rum.

ELLIOTT, E. E.—"Estate" Rum.

MUDIE, D. T.—"Estate" Rum.

SIMPSON-CARSOM, J.—"Estate" Rum.

DAVIS, H., & SON.—"Estate" Rum.

HAY, HEIRS OF.—"Estate" Rum.

THOMSON, ELIZA.—"Estate" Rum.

JACKSON, J.—"Estate" Rum.

SCHARSCHMIDT, S. T.—(a) Sweet Orange Spirit; (b) Seville Orange Spirit; (c) Sweet Orange Wine.

WRAY, J., & NEPHEW.—Orange Wine (coloured). Orange Wine (white). Ginger Wine (coloured). Ginger Wine (white). Pimento Dram. Prune Dram. Bitters. Lime Juice. Noyeau.

DELGADO BROTHERS.—Quinine Bitters.

DESNOES, P., & SON.—Ginger Wine (white). Ginger Wine (coloured). Orange Wine. Orange Juice. Falernum. Bitters. Peppermint Cordial. Aniseed Cordial. Pimento Dram. Noyeau. Parfait Amour. Rosolio. Anison.

SIMON & LEARY.—Rosolio. Noyeau. Ginger Cordial (white). Ginger Wine (white). Peppermint Cordial. Casheu Wine. Orange Wine (white). Orange Wine (coloured). Orange Cordial. Peppermint Wine. Pimento. Prune. Bitterine. Liqueur d'Or. Bitters. Rum Shrub.

TRINIDAD.

Spirits, &c.

FRANCOIS, B. D.—White Rum.

RODRIGUEZ, J. T., JUN.—White Rum.

TURNBULL, STEWART, & Co.—White Rum (Brechin Castle Estate).

CLAUDIO DA COSTA.—Coloured Rum.

DEVENISH, A.—Coloured Rum (Mount Pleasant Estate).

RODRIGUEZ, J. T., JUN.—Coloured Rum.

TURNBULL, STEWART, & Co.—Coloured Rum (Caroni Estate).

FRANCOIS, B. D.—Red Rum (made at Usine St. Madelaine).

DEVENISH, A.—Old Rum (Mount Pleasant Estate).

FRANCOIS, B. D.—Old Rum (made at Usine St. Madelaine).

RODRIGUEZ, J. T., JUN.—Old Rum.

TURNBULL, STEWART, & Co.—Old Rum (Brechin Castle Estate).

FRANCOIS, B. D.—(a) Absinthe. (b) Anisette. (c) Curaco. (d) Leasure Drink. (e) Ratafia de Cacao. (f) Ratafia de Café. (g) Ratafia de Vanille. (h) Shrub.

MORIN, F.—Stamachio Shrub.

SIEGERT & SONS, J. G. B.—(a) Angostura Liqueur. (b) Siegert's Bouquet.

BATTALLA & SON, A.—Amargo Essencial de Venezuela.

DUMMETT, N. R.—Iere Bitters.

FRANCOIS, B. D.—Tropical and Vegetable Bitters of the West.

RAMSEY, F. A.—The Trinidad Aromatic Bitters.

REECE, RUPERT F. E.—Orange Bitters.

SIEGERT, J. G. B., & SONS.—Aromatic or Angostura Bitters.

BARBADOS.

Spirits, &c.

CARTER & Co.—Rum, from cane juice, 1884 (proof). This sample gained the prize at the local Agricultural Society's Exhibition, 1885. Rum, from cane juice, 1885, 57 per cent. over proof. Rum, from juice of rotten cane, 1885, 20 per cent. over proof. Rum, from cane juice and molasses, 1885, 40 per cent. over proof. Rum, from molasses, 40 per cent. over proof.

HUTCHINSON, G. W., & Co.—Rum, re-distilled.

LOUIS, SON, & Co.—Rum, 30 per cent. over proof.

MURRAY, A. P.—Rum (old), made at Thicket Estate, bottled in 1871.

WITHAM & BUTTERWORTH.—Rum, seven years old, from Hannay's Estate.

SEALY, GEORGE A.—Rum (old), bottled in 1841.

BELFIELD, A.—Liqueurs, &c., Cordials. Falernum, white.

HUTCHINSON, G. W., & Co.—Falernum, white.

CARTER & Co.—Falernum, white.

PETERSON, C. R.—Falernum, white.

CARTER, A. P.—Falernum, white. Falernum, golden.

CARTER & Co.—Shrub.

THE COMMITTEE.—Sorrel Liqueur.

BELFIELD, A.—Milk Punch.

CARTER & Co.—Milk Punch. Wormwood Bitters.

BELFIELD, A.—Wormwood Bitters.
SHEPHERD & Co., of Nile Hotel.—Wormwood Bitters. Orange Bitters. Shaddock Bitters.
CARTER & Co.—Quassia Bitters.
THE COMMITTEE.—Syrup Orange. Syrup Lemon.

WINDWARD ISLANDS.

ST. VINCENT.

Spirits, &c.

PORTER, ALEX.—Very Old Drinking Rum.
SIMMONS, C. J., Kingston.—(1) New Rum, 38 per cent. over proof (made on Colonaric Vale Estate). (2) New Rum, 35 per cent. over proof (made on Mount William Estate). (3) New Rum, 34 per cent. over proof (made on Mount William Estate).
MACDONALD, Wallilabo.—(1) Old Drinking Rum, 1867. (2) Old Drinking Rum, 1877.
SMITH, WILLIAM, Kingston.—Old Drinking Rum, upwards of ten years old (made on Clare Valley Estate).
PARSONS, WILLIAM, Hopewell.—Bay Rum (made on Hopewell Estate).
HUGGINS, P. FOSTER, Golden Vale.—Sorrel Liqueur.
MACDONALD, Wallilabo.—Shrub, 1877.

TOBAGO.

Spirits, &c.

White Rum. As distilled from fermented saccharine matters in Shear's patent stills.—(a) Betsey's Hope Estate. (b) Roxboro' Estate. (c) Pembroke Estate. (d) Goldsboro' Estate. (e) Messrs. S. B. Isaacs & Co. (f) Messrs. J. McCall & Co. (g) T. L. Rowe, Esq., Mt. Irvine Estate (high proof).

Coloured Rum. White rum, reduced, cured and coloured.—(a) Betsey's Hope Estate. (b) Roxboro' Estate. (c) Pembroke Estate. (d) Goldsboro' Estate. (e) T. L. Rowe, Esq., Mt. Irvine Estate (old). (f) Mr. F. A. Gray. (g) Messrs. J. B. Isaacs & Co. (h) Messrs. J. McCall & Co.

Rum Shrub. A liqueur made with rum, lime juice, and sugar.—(a) H. H. Sealy. (b) F. A. Gray. (c) J. D. Kerwood. (d) J. L. Gibbes. (e) Mrs. Purser. (f) Dr. J. G. Anderson. (g) R. B. Anderson. (h) Messrs. J. McCall & Co.

Falernum. A liqueur made with rum, lime juice, water, and sugar.—(a) A. Murray. (b) J. D. Kerwood. (c) H. H. Sealy. (d) Mrs. T. Newton Browne. (e) R. B. Anderson. (f) Messrs. John McCall & Co.

Sorrell Bounce. Made by macerating the dried sorrel in rum and sweetening.—(a) Mrs. Purser. (b) Miss Willington. (c) R. B. Anderson. (d) Mrs. A. Clarke. (e) J. P. Tulloch.

Hog Plum Liqueur. Made by macerating the fruit in rum and sweetening.—(a) R. B. Anderson.

Ginger Wine. By usual home process.—Mrs. Purser.

Native Bitters. Made by maceration of the chief ingredients in rum, with the addition of special flavours to taste.—(a) Dr. J. B. Tulloch. (b) Alex. Clark. (c) J. D. Kerwood. (d) Wormwood, Mrs. Purser. (e) Halbert weed, Mrs. Purser. (f) Quassia wood, Mrs. Purser. (g) Orange, Dr. Clark.

Bay Rum. The aromatic spirit made by re-distillation of rum with bay leaves.—J. G. McCall.

Syrups.—(a) Dr. J. P. Tulloch. (b) J. G. McCall. (c) F. A. Gray. (d) J. L. Gibbes. (e) Mrs. McKillop.

ST. LUCIA.

Rum.

AGRICULTURAL SOCIETY.—(a) Bay rum. (b) Lemon-grass rum.

LEEWARD ISLANDS.

ANTIGUA.

Spirits, &c.

FORREST, WM.—Falernum.
HARPER, JAS.—Rum.
LEES, SIR C.—Milk Punch.
NUGENT, O.—Milk Punch.
ROCKE, JAS.—Rum.

ST. CHRISTOPHER—NEVIS.

Rum, Liqueurs.

Rum made on the Profit Estate, the property of Messrs. R. and T. Neave, London.
Rum.—(a) White. (b) Coloured, from Brighton Estate.
Liqueur ("Dr. John").
Ginger Wine.

DOMINICA.

FILLAN, J. COX.—Noyeau Water, Wall House Estate. Rum, Wall House Estate.
DAVIES, WILLIAM.—Old Rum, Bath Estate. Rum Shrub, Bath Estate.

MONTSERRAT.

HOLLINGS, JAS.—Bay Rum. White Spirits. Orange Wine.

BRITISH HONDURAS.

Spirits, &c.

Sorrel Wine, from Regalia Estate, Sittee River. Exhibited by J. Halliday.
Shrub, from Santa Rita Estate, Corozal. Exhibited by Capt. Hall.
Falernum, from Santa Rita Estate, Corozal. Exhibited by Capt. Hall.
Rum, coloured, 46 o.p. (bright in colour), from Santa Rita Estate, Corozal. Exhibited by Capt. Hall.
Rum, coloured (Jamaica flavour), 35 o.p. (1883), from Santa Rita Estate, Corozal. Exhibited by Capt. Hall.
Rum, coloured (Pineapple), 38 o.p. from Santa Rita Estate, Corozal. Exhibited by Capt. Hall.
Rum, white, 48 o.p., from Jonesville, Corozal. Exhibited by Jones and Young.
Rum, white, 30·6 o.p., from Jonesville, Corozal. Exhibited by Jones and Young.
$\overset{P}{SC}$ No. 15, Rum, coloured, 4 years old, from Santa Cruz. Exhibited from A. Porter.
$\overset{P}{SC}$ No. 19, Rum, coloured, from Santa Cruz. Exhibited by A. Porter.
Rum, white, 48 o.p. (1885), from J. Satillo, Corozal. Exhibited by A. Romero.
Rum, coloured, from J. Satillo, Corozal. Exhibited by the Government.
Rum, coloured, 31 o.p., from San Pedro, Corozal. Exhibited by Tiburcio Carrillo.
Rum, coloured. Exhibited by the Government.
Rum, white. Exhibited by the Government.

NATAL.

JONSSON, F. L.—Rum and Pineapple Rum.
PARENT, CAMILLE.—Rum and Pineapple Rum.

MAURITIUS.

ROUHIER FRÈRES, J. & A.—(1) Liquors. (2) Rum. (3) Rum prepared for exportation.
FELIX & CHAUVET.—(1) Rum. (2) Liquors.

PROTECTED MALAY STATES.

E. BROWN, ESQ., Province Wellesley.—Samples of Rum.

HON. J. VERMONT, Province Wellesley.—Samples of Rum. From the Batu Kawan Estate.

J. MCDOUGALL, ESQ., Province Wellesley.—Samples of Rum. From the Caledonia Estate.

CYPRUS.

Spirits, &c.

CRIST HAGGIPAVLU & FILS, Limassol. — Ginger Brandy. Old Tom Gin. Mastic Raki.

NICADINOS, N. G., Larnaca.—Spirits of Wine.

CANADA.

Malt Liquors.

BOSWELL, J. K., & SON, Quebec.—Ale and Porter.

CARLING BREWING AND MALTING COMPANY, London, Ontario.—Ale, Porter, and Lager Beer.

CARTER BROTHERS, Victoria, British Columbia.—Ale and Porter.

DAWES & CO., Lachine, Quebec.—Canadian Ale and Porter.

GOWER, C., Victoria, British Columbia.—Ale, Beer and Stout.

JONES BREWING COMPANY (ROBERT BRIMS), Halifax, Nova Scotia.—Ale and Stout.

JONES, SIMEON, St. John, New Brunswick (Agent, MA IRA CORNWALL, JUN., Canadian Section).—Ale and Porter.

KEITH & SON, Halifax, Nova Scotia.—Ale and Porter.

LABATT, JOHN, London, Ontario.—Ale and Stout.

LOEWEN & ERLE.—Beer.

OLAND, S., SONS, & CO., Halifax, Nova Scotia.—Ale and Stout.

O'MUSLIN, P. B. & J., Halifax, Nova Scotia.—Ale and Porter.

PRESCOTT BREWING COMPANY, Prescott, Ontario.—Ale and Porter.

VICTORIA.

Malt Liquors.

BILLSON, ALFRED A., Beechworth.—Bottled Ale. Bottled Porter.

BOYD & HEAD, Shamrock Brewery, Collingwood.—Two hogsheads of Ale, from Victorian malt and hops. Bottled Ale. Trophy for Beer.

COHN BROTHERS, Brewers, Sandhurst.—Lager Beer, specially brewed on "under-fermentation" principles. This Lager Beer has been brewed entirely on the German principle, that is, by the decoction mash process and under-fermentation. The Lager cellars are constructed on the German principle. The main building is of wood, and comprised of a double wall six inches in space, in which is closely packed sawdust. The entire building is thatched with 18 in. of straw. A corrugated iron building, two feet from the thatch, encloses the whole structure above the cellar. A large quantity of ice is always stored, in order to keep the temperature of the cellars down to 37° F.; and, as the temperature must never vary, it is necessary to constantly renew the ice as it thaws. It is calculated that for every hundred gallons of beer brewed, 22 cwt. of ice is required for cooling it. Every bottle of beer, therefore, requires 4 lbs. of ice for cooling it alone, and the beer is stored in the cellar for nearly three months; hence the necessity for the large amount of ice. The fermenting room, which is on a level with the ice above the cellar, is kept at a temperature of 40° F. The machinery comprises No. 3 Vass and Littman's Ice Machine, Pitching Machine, Air Pressure Pump, Wort Pump, Mash Pump, &c. The ice machine is kept almost constantly at work, and turns out 2 tons of ice per diem. A large pitching machine is also constantly working, in order to thoroughly prepare the casks for the reception of the beer.

HEDLEY BROTHERS, Bridgewater, Loddon.—Bottled Ale. Bottled Stout.

HURST, EDWARD, & CO., Spring Creek Brewery, Beechworth.—Ale. Porter.

LOAN, LEWIS, Walhalla, Gippsland.—Bottled Ale.

MELBOURNE BREWING AND MALTING COMPANY, LIMITED (EDWARD LATHAM, Managing Director), Carlton Brewery, Melbourne.—Running Ale. Stock Ale. Porter.

McCRACKEN & Co., City Brewery, Melbourne.—Australian Bitter Ale, in wood and bottled; a Trophy formed with Stand, Casks, Show Cards, Bottles, &c. The casks and stand are entirely made from Victorian wood. The trophy consists of a stand made of Australian red-gum (a wood impervious to moisture) and six hogsheads of Australian blackwood. This latter wood is used extensively for railway-carriage building and other purposes; it is also suitable for cask-making. The casks have been made by Messrs. Gray and Waring, of Melbourne, coopers specially employed by the Exhibitors. The exhibit of beer has been brewed at Messrs. R. McCracken and Co.'s City Brewery, Melbourne, a view of which is given around the trophy. The beer is produced from Victorian malt and hops only. Both the barley and hops used were grown in Victoria. In addition to the beer exhibited (which could be tested at the refreshment bar in connexion with the Court), Messrs. R. McCracken and Co. produce various other ales and stout. Their brewing business was commenced upwards of thirty years ago, when their first brew consisted of five barrels only, but has now increased to upwards of 300 barrels per brew, their yearly production being above 100,000 barrels and increasing daily.

SHELDRICK, WALTER, & Co., New Brewery, Warrnambool.—Ale in bulk, Porter in bulk, Bottled Ale, Bottled Stout.

NEW SOUTH WALES.

Malt Liquors.

ELWIN, W. H., & Co., Standard Brewery, Orange.—Ale and Porter.
McCALLUM & Co., Macquarrie Brewery, Dubbo.—Ale.

SOUTH AUSTRALIA.

Malt Liquors.

CHAMBERS & BLADES, Dragon Brewery, Adelaide.—Stout.
GRAY, GUILDFORD E., Hyde Park Brewery, Unley.—Ale and Porter.
PHILLIPSON BROS., Hackney, near Adelaide.—Ale and Porter.

WESTERN AUSTRALIA.

Malt Liquors.

FERGUSON & MUMME, MESSRS., Perth.—Ale and Porter.
JONES & HALL, MESSRS., Stanley Brewery, Perth.—Ale.
HARWOOD & SMITH, Lion Brewery, Perth.—Ale.

QUEENSLAND.

Malt Liquors.

McKAY, B., Mackay.—Bottled Ale.

STEINDL & FLEMING, City Brewery, Bundaberg.—(1) Ale and Stout, in cask. (2) Bottled Ale and Stout.

TOWNSVILLE BREWERY COMPANY, LIMITED, Townsville.—Bottled Stout and Ale.

NEW ZEALAND.

Malt Liquors.

EHRENFRIED BROS., 43 Queen Street Wharf, Auckland.—Ale and Stout, brewed at the Thames, bottled in Auckland. Ale and Stout, brewed at the Thames.

FRANCIS FRANKS, Eclipse Brewery, Temuka, Canterbury. — (1) Strong Ale, intended to take the place of English ale in the Colony of New Zealand. (2) Ordinary

Colonial Ale, commonly called XXX. Both brewed from Colonial malt and New Zealand grown hops.

MAURICE, JOEL, Great King Street, Dunedin.—Ale, Stout; Ale and Stout.

SCARLETT & Co., Suffolk Brewery, Barbadoes Street, Christchurch.—Light Bitter Ale, 16 lbs. weight, brewed from Nelson hops and Canterbury malt only. Mild Ale, 21 lbs. weight, brewed from Nelson hops and Canterbury malt only.

SPEIGHT, JAMES, & Co., City Brewery, Dunedin.—Strong Ale, XXXX Ale, Pale Ale.

STRACHAN, WILLIAM, Pitt Street, Dunedin.—Pale Ale, XXXX Ale.

VINCENT & Co., City Brewery, Christchurch.—Bitter Ale, under 25 lbs. specific gravity. Strong Ale, under 30 lbs. specific gravity.

MISCELLANEOUS SAMPLES.

CANADA.

MCCREADY, THOMAS, & SONS, Portland, New Brunswick.—White Wine Vinegar, Cider, Vinegar (proof).

TROOP, GEORGE A., St. John, New Brunswick.—White Wine, Cider, Vinegar.

BRITISH GUIANA.

PLANTATION TAYMOUTH MANOR.—Vinegar (Cane Juice).

MAURITIUS.

ROUHIER FRÈRES, J. & A.—Vinegar, Eau de Cologne.

CYPRUS.

LANITI, G. L., Limassol.—Grape Vinegar.

NEW ZEALAND.

DIXON, MRS. GEORGE, Wellington.—Raspberry Vinegar.

THOMSON & Co., Dunedin.—Raspberry Vinegar.

QUEENSLAND.

BAIN, JAMES, Ipswich.—Malt Vinegar.

WESTERN AUSTRALIA.

CLINCH, J., Berkshire Valley.—White Wine Vinegar, Mulberry Vinegar.

NEW SOUTH WALES.

ONSLOW, MRS. A. A. W., Camden Road, Menangle.—Mulberry Vinegar.

MONK, DAVID JOSEPH, Sydney.—Malt Vinegar, Wine Vinegar.

SOUTH AUSTRALIA.

BARNFIELD, TURNER, & Co., London Condiment Works, East Adelaide.—Raspberry Vinegar, Lemon Syrup, Essences.

BARTON & Co., Hackney, near Adelaide.—Vinegar.

BICKFORD, A. M., & SONS, Adelaide.—Raspberry Vinegar.

CROWDER & Co., Adelaide.—Raspberry Vinegar.

HALL, GEORGE, & SONS, Norwood, near Adelaide.—Raspberry Vinegar.

ROBERTSON, J., Adelaide.—Vinegar.
ROSS, HON. R. D., M.P., Highercombe.—Cider, Sparkling and Still.
SEPPELT, B., Seppeltsfield.—White Wine Vinegar.
WAVERLEY VINEGAR COMPANY, Adelaide.—Fine Table Vinegar, Wine Vinegar, Crystal Vinegar.

VICTORIA.

HURST, E., & Co., Beechworth.—Raspberry Vinegar.
DIXON, P. G., & Co., Melbourne.—Raspberry Vinegar.
LOAN, L., Walhalla.—Raspberry Vinegar.

TOBACCO.*

By G. WATT, M.B., C.M., F.L.S., C.I.E., and JOHN MCCARTHY, F.I.C., F.C.S.

I. Its history.—The tobacco plant is a native of the new world. It has been acclimatised in most warm temperate countries, or in tropical regions which possess a temperate winter. It was discovered by Columbus. The messengers whom he sent in October 1492, to explore the island of Guanahani (afterwards called by him San Salvador) returned with the report that they had seen natives inhaling the smoke from burning rolls of the dried leaves of a plant, called by them *cohiba*. The burning rolls were smoked in curiously bifurcated tubes which they called *tobaco*, or *tobago*. By a remarkable misapplication of a name, tobacco or some evident derivative from that word has come to be applied to the plant in every country where it is either grown or smoked, a fact which affords strong evidence of a common origin, both for the plant and for the name. It is worthy of a passing note that bifurcated cigars and pipes are still met with.

The North American pipes have two bowls, and the Gaboon pipes are double-stemmed. In India, double cigars are not uncommon, both cigars being smoked at once through a short uniting stem of tobacco. The older American pipes, discovered in the tombs of the Aztecs in Mexico and in the mounds of the United States, which may be seen in collections, are, however, single pipes of a heavy construction, and made of clay or stone, and often in the form of animals. It would appear that prior to European influence, the inhabitants of South America did not smoke, but, instead, chewed or snuffed tobacco. The early West Indians would thus appear to have smoked cigars, and it is further narrated that their cigar-holders or wrappers were constructed from the spathe of the maize (Indian corn). This practice prevails to the present day in many parts of the world. The inhabitants of Orissa, in the Presidency of Bengal, for example, smoke cigars having green plantain leaf wrappers, and throughout Western India a considerable trade is done in *bidis* or cigar-wrappers of the dried leaves of *Bauhinia racemosa*. The Santals, a people who inhabit the mountains of the central portion of Bengal, twist the leaves of the *sál* tree (*Shorea robusta*) into cigar-holders or pipes in which they smoke their tobacco. But a volume might be written on the cigar-wrappers used in the various parts of the world. Suffice it to add that it is surprising that the bark of the South American tree (*pao d'arco*) has not found its way into European commerce as a wrapper for cigarettes. By those persons who have once tried this delicate paper-like tissue, it is infinitely preferred to any artificial cigarette paper.

The cigars used in Holland, in the year 1570, had palm-leaf tubes or covers, and it would thus be most instructive to discover when and where the modern or European habit originated of employing specially selected tobacco leaves as covers, or wrappers for cigars in place of tubes of a

* In this Report India has been included.

different material. We might be almost permitted to advance the idea that this change followed the introduction of the pipe. The Santal wrappers are often shaped like pipes, and it might be assumed that the substitution of a bamboo joint or reed, in place of the wrapper that was consumed, and which flavoured the tobacco, would be a very natural and simple improvement. To affix to a bamboo joint, a reed mouthpiece, is to produce the form of pipe which is generally claimed as of European origin—the clay pipe.

Bamboo pipes with reed mouthpieces are in use, as a matter of fact, among many of the hill tribes of India, Africa, and other parts of the world. It is also just possible that the suggestion to use a pipe emanated from the East, being borrowed from the ancient practice of smoking *ganja*, or the narcotic derived from hemp. Tobacco pipes closely resembling the *ganja* and opium pipes are in common use in many parts of India. Clay pipes are not made in India of the bamboo joint pattern; but pipes in that shape are made both in stone and of brass by the inhabitants of the higher mountains, pipes which are very similar to the metal pipes used by the Laplanders. The first mention of clay pipes occurs in 1585, at which date they were used both in England and Virginia.

By far the most common pipe in India, at the present day, is one or other of the forms with a water-vessel through which the smoke is drawn. These may be said to be of three kinds. The first is the *hukah* or Hindu pipe, in which the cocoa-nut shell serves as the water-vessel. In this form, the mouth is either applied direct to an opening near the top of the shell, or through that opening a short reed-like mouthpiece is passed. The small furnace, with the tobacco mixture, is borne upon a tube which dips to near the bottom of the water.

Next comes the Mahomedan *hubble-bubble* in which the water-vessel, if of the cocoa-nut shape, rests in a stand, or is made more in the form of a *sarhai*, and thus placed by itself on the floor. By means of a long flexible tube, this form is smoked luxuriously, or may be so constructed as to have two or more tubes allowing of more than one person to smoke at once. Lastly, the water-vessel may be a small joint of bamboo dropping at an acute angle from the mouthpiece, and having on its apex a small stone tobacco bowl. It is somewhat remarkable that throughout the various languages and dialects of India, the people speak not of smoking, but of drinking tobacco, and this same expression was used in England in 1584. The Turk calls his hubble-bubble *nargileh*, and in India, *narikel* is the name of the cocoa-nut, so that it is just possible that, at least, the various forms of smoking pipes, with water-vessels, came from India, the original bowl being the cocoa-nut shell.

Perhaps one of the most primitive forms of tobacco-smoking is that practised by the aboriginal tribes, and even by the Hindus who inhabit some of the higher North-West Himálaya. A small hole is dug in the ground on the face of a sloping bank. By means of a twig, a channel is made to communicate with the bottom of this miniature tobacco furnace. The tobacco is then ignited, and the furnace almost covered over with earth. The hand is closed and placed against the communicating channel, and the mouth over the hand. By suction the smoke is inhaled, each member of the party kneeling down and taking one or two mouthfuls. Another mode is to beat soft mud around a walking stick on a large rock

or stone. On withdrawing the stick, a mud tube is left, the end of which is closed, and a small hole made on the top, near the closed end. This is worked into a furnace for the tobacco, and the smoke inhaled through the further end.

In Africa, the use of the pipe is general, each tribe having a peculiar pipe of its own. The shapes of these pipes vary from what we have called the European type to others widely different. It is not uncommon to find bamboo pipes, and others made of stone, clay, iron, or other metals. In Ujiji, according to Mr. Joseph Thomson, the natives do not smoke the tobacco, but, instead, charge the nostrils with a decoction of tobacco which is retained by a pair of pinchers. In the Masai land, tobacco is mixed with carbonate of soda, and in this preparation it is chewed. The Rev. J. Sibree, in his account of the Malagasy tribes of Madagascar, says that tobacco, in a form like snuff, mixed with ashes and salt, is taken into the mouth, and he narrates the native story as to what led them to the habit of chewing this form of tobacco. A favourite child died, and the parents vowed they would eat whatever grew on its grave. Tobacco sprang up, and after many vain efforts, they discovered how to eat, or rather, chew that weed. The Ujiji habit recalls the Angami Naga practice of employing old women to smoke all day long, so as to accumulate a quantity of nicotised liquid. This is boiled down to a thick decoction, and carried by the males in small boxes for the purpose. A friendly salutation consists in presenting these boxes. The tip of the finger is dipped into the liquid, and then applied to the tongue. The Kwapuí Nagas of Manipur smoke violently pipes containing green tobacco, but they admit that the pleasure of doing so is nothing compared to that derived from holding in the mouth a sip of the water derived from the bamboo water-bowl, after it has been well impregnated with the fumes of the smoke.

Tobacco would appear to have been first introduced into Europe in 1559 by Hernandez de Toledo, and into England by Sir John Hawkins from Florida in 1565, and by Sir Francis Drake from Virginia in 1586. The practice of smoking soon after that date became common among the courtiers of Queen Elizabeth. This is generally viewed as having been largely due to the example of Sir Walter Raleigh. Be that as it may, the habit of smoking tobacco and of using snuff spread very rapidly, being accelerated rather than restricted by the efforts made to suppress the indulgence. In 1590 Shah Abbas of Persia prohibited the use of tobacco, the punishment being to have the nose slit open. In Russia this punishment was also inflicted on a second offence, and a tribunal which sat at Moscow 1639, laid down the law regarding this crime. Pope Urban VIII. in 1624, and Pope Innocent XII. in 1690, excommunicated persons who snuffed in church or smoked in St. Peter's at Rome, and these prohibitions were not removed until 1724. In Switzerland smoking was ranked next to adultery, and the penal enactments against it were in force until the middle of the eighteenth century. In England King James I. imposed what was then regarded as a prohibitive import duty upon tobacco, namely 6*s.* 10*d.* a pound, and he published his "Counterblast" in 1619. His Majesty called it a custom loathsome to the eye, hateful to the nose, harmful to the brain, and dangerous to the lungs, and he compared the black "stinking fumes" to the "smoke of the bottomless pit." About the same period, however, it is on record that ninety

young women were sent from England to America and sold to planters in exchange for tobacco, each fetching about 120 lbs.

Tobacco was introduced into India in 1605, during the reign of the Emperor Akbar. The great Mughal ruler does not appear himself to have acquired the habit of smoking, but he said, "Truly we must not reject a thing which has been adopted by the wise men of other nations, or how shall we progress?" His successors at Delhi were less liberally-minded, and even prohibited the use of "the weed." In spite, however, of persecution, the habit of tobacco-smoking progressed rapidly in India as in other parts of the world, and it is perhaps a safe estimate that at the present day one-half the entire population (or say 120,000,000 of people), men, women, and children, Hindus, Mahomedans, and aboriginal races, smoke tobacco in some form.

Tobacco appears to have been introduced into China and Japan at about the same time as it found its way to India, and it also rapidly spread over the rest of the world. It was permitted to be smoked by one ruler and prohibited by another, but all the while the habit steadily advanced and gained strength. Perhaps no other plant is now so much used by the inhabitants of the world as tobacco. It has been calculated that one-fourth the entire human family employ it in some form or other, either smoking, chewing, or snuffing it.

Prior to the separation of the United States the British supply came almost entirely from Virginia. During the reign of Queen Anne the annual revenue from tobacco was only about £250,000. Last year the imports were 83,227,297 lbs., valued at £3,900,559, and the consumption 53,055,984 lbs., which yielded a revenue of £8,975,140, or considerably over one-third the total customs revenue. During the past century the revenue has increased from half a million to close upon nine millions of pounds sterling. In England tobacco cultivation was allowed in 1620, but the grower was not permitted to sell the produce. The prohibitive duty imposed upon Virginia tobacco at first procured a high revenue, but as the duty did not extend to Spanish and other tobaccos, the amount of the latter poured into the country soon began to tell on the revenue; and besides, Virginia tobacco often came *viâ* Spain, and thus escaped duty. A change in the law was effected, and to encourage American and the then other British Colonial-grown tobaccos, a heavier duty was imposed upon all foreign tobaccos.

In 1651 the cultivation of tobacco was absolutely prohibited within the Commonwealth, excepting in "physic gardens," but the act did not extend to Ireland until 1831, at which date there were 600 acres under tobacco and as much as £100 an acre obtained. This was of course largely due to the fact that Irish tobacco paid no duty. Within the past twelve months the experimental cultivation of tobacco has been permitted in England, and experienced growers, both in America and elsewhere, have expressed the opinion, that if allowed to grow it, the English farmers would find tobacco much more profitable than either wheat or corn. It is difficult to avoid the inference that the enactments regulating tobacco in Great Britain have driven a remunerative industry into foreign countries. The evil effects of this have, however, begun to be removed by the great and growing trade in British manufactured cigars and other tobaccos, and a hopeful reaction has also set in by the greatly extended cultivation of tobacco in the British Colonial and Indian possessions.

II. Description of the various species of tobacco-yielding plants.—The genus of plants which yields the tobacco of commerce belongs to the potato family—*Solanaceæ*. It has been named *Nicotiana*, in honour of the French ambassador at Lisbon (Jean Nicot), who in 1560 brought the plant into France. There are some fifty species known, but only two or at most four are cultivated for the leaf. The two principal commercial forms are by some botanists treated as varieties of one species, and not as distinct species. These are—

1. *Nicotiana Tabacum.*—This is the most extensively cultivated form, and may be at once recognised by its longish pink flowers and tapering oval-lanceolate, sessile leaves. M. de Candolle views this as a native of America, extending as far north as Mexico, and as far south as Bolivia, and eastward to Venezuela.

2. *N. rustica.*—This is easily recognised by its short greenish flowers and stalked, ovate, cordate leaves. The leaves are coarser and more crumpled than those of the preceding. This is popularly known as the Turkish form, but it is most probably a native of Mexico and California.

Of these two species the former seems much the hardier, and in most countries where it is cultivated to any extent, it has become acclimatised, springing up in great profusion, self-sown. The latter form, on the other hand, is rarely found to do this, and is thus met with only under cultivation.

3. *N. repanda.*—This is not very extensively cultivated, but it is said to yield some of the finer qualities of Cuban and Havana tobaccos.

4. *N. persica.*—This yields the Shiroz or Persian tobacco.

5. *N. angustifolia.*—A species found in Chili, yielding a very strong tobacco.

How far the properties of the known commercial kinds of tobacco may be traceable to these species or to hybrids between them, is a point which deserves further investigation. It is probable that the soil and climate are far more important. It is commonly reported that the West Indian, Latakia and American tobaccos are obtained from cultivated qualities of *N. Tabacum*, while the Manilla, Turkish, Hungarian, and East Indian are reputed to be derived from *N. rustica*. We can speak with a certain degree of assurance regarding the commercial forms of East and West Indian tobaccos. Both these are derived exclusively from *N. Tabacum*. In India *N. rustica* is only cultivated to a very limited extent, and chiefly in Eastern Bengal and Cachar, and the leaf is never, as far as we have been able to ascertain, exported to Europe. *N. Tabacum* has become an abundant weed in many parts of India; around Calcutta, for example, in every dark and damp lane through the villages and neighbouring bamboo jungles, and on every wall and roadside, a stunted form of *N. Tabacum* * is found to be one of the commonest weeds, and, indeed, on the sandy islands of the Hoogly and Ganges, this plant has practically exterminated the indigenous vegetation, and may be seen covering miles of these newly-formed tracts of country. The plants spring up at the close of the rains and flower in early summer. The Commissioner for West Australia, at the Colonial and Indian Exhibition, reports a similar state of affairs, the self-sown plants appearing in West Australia during the wet season,

* According to some botanists the wild tobacco of Bengal is known as *plumbaginifolia*.

and "attaining a height of as much as four feet before being scorched and dried up with the recurrence of the hot season."

III. The trade in tobacco.—It is difficult to obtain trustworthy information regarding the world's trade in tobacco. The French statistical society estimates the annual consumption at 4480 million pounds, and it is probable that the area under tobacco is not far short of six million acres. In the United States alone there are annually close upon 600,000 acres, and in India 317,000 acres. Viewing the trade of the United Kingdom alone, the following tabular statement of the consumption of tobacco and revenue therefrom is instructive as showing the magnitude of the trade and the steady way it has developed :—

Year.	Consumption.	Revenue.
1790	10,700,316 lbs.	£ 696,804
1800	19,490,199 ,,	1,388,193
1810	21,133,083 ,,	2,093,495
1820	16,519,515 ,,	2,904,251
1830	18,899,137 ,,	2,828,968
1840	22,971,406 ,,	3,431,908
1850	27,538,104 ,,	3,337,258
1860	35,106,641 ,,	5,529,400
1870	40,845,253 ,,	6,433.147
1880	48,191,555 ,,	8,433,538

Last year (1885–86) the imports of tobacco were 83,227,297 lbs., and the consumption 53,055,984 lbs., and the exports were 8,084,574 lbs., while the total amount in bond was declared to be 93,767,377 lbs. The value of the tobacco imported last year into Great Britain was £3,900,599, and the revenue obtained from tobacco amounted to £8,975,140. Thus it would appear that in ninety-five years the consumption of tobacco in Great Britain and Ireland has increased from 10,700,316 lbs. to 53,055,984 lbs., and the revenue derived from tobacco by Government during the same period has increased from £696,804 to £8,084,574. It is noteworthy that of the imports only 4,307,789 lbs. were returned as manufactured tobaccos and snuff, and of this only 1,730,924 lbs. are stated to have been consumed. At the same time the United Kingdom exported 1,368,780 lbs. of manufactured tobaccos. These figures when considered alongside of the quotation given as the total of the imports of the manufactured tobacco, convey some idea of the magnitude of the British or home trade in manufacturing or preparing tobacco for the consumer. The Havana, Manilla, and other foreign made cigars, must be viewed as but luxuries as compared with the infinitely larger trade, in British manufactured tobacco and cigars.

Speaking of the cigar trade, our Colonies and India have to compete mainly with the home-made, and not with the finer qualities of foreign cigars. This fact has caused some authorities to advance the idea that the present system of imposing one uniform duty upon all manufactured tobaccos, whatever may be their value, is unjustly severe upon our Colonial and Indian manufacturers. It is admitted that they cannot compete with

the Havana and Manilla cigars, and the low duty upon unmanufactured tobaccos as compared with manufactured, allows the British manufacturer to produce a cheaper article at home than can be sent from the Colonies and India to England. It is, however, believed that many of the Colonial and Indian tobaccos and cigars have properties of their own that would commend them to a large number of consumers, were it possible that they could be sold in England at a price that would enable them to compete with the British manufacturer.

Since the 5th of April, 1878, the duty on manufactured tobaccos has been 3*s.* 6*d.* a pound, provided it contains 10 per cent. moisture, and 3*s.* 10*d.* if less than that amount. Thus while the duty is not lessened when the tobacco contains more than 10 per cent. moisture, it is raised when it contains less. The duty on cigars has since the 4th of April, 1879, been fixed at 5*s.* 6*d.* a pound, regardless of their intrinsic value, or the amount of moisture they contain. The question of moisture is one of the very greatest importance, for it may not inaptly be said that the profits made in the tobacco trade at the present day are entirely due to water. We are indebted to Mr. J. Chambers (of Messrs. Grant, Chambers and Co.) for much valuable information regarding the tobacco trade, and may here quote a passage from a private letter of his on the subject of profit. "About 75 per cent. of the tobacco cut for the pipe is sold in the shape of "Shag" at 3*d.* an ounce retail; the manufacturer sells this at 3*s.* to 3*s.* 2*d.* a pound, so that taking the average cost of tobacco at 6*d.*, and the duty at 3*s.* 6*d.*, the article is sold at considerably below cost price." This is due to the fact that the article comes into the hands of the manufacturer in a dry state, and the profit is due to the increased weight, on the addition of moisture in the process of manufacture. A tobacco, to use the technical term, must "drink" well to be profitable.

IV. Chemistry of tobacco.—The active principle of tobacco is a volatile highly poisonous alkaloid termed *Nicotia* or *Nicotine.* According to some chemists this substance is present in the smoke, but by other observers this is denied. By distillation with water, tobacco leaves yield a concrete volatile oil known as Nicotianine, or tobacco camphor. This has been defined as a fatty acid contaminated with a little volatile oil. It is tasteless, but possesses a tobacco-like smell. One of the most important groups of constituents in tobacco is its inorganic. The ash of tobacco is found to amount to as much as from 16 to 17 per cent., and the principal ingredients are phosphoric acid, potash, a large amount of nitrogen (chiefly in the form of nitrates), and lime. It is somewhat remarkable that seed from the same stock grown on different soils will produce entirely different tobaccos, the inorganic constituents bearing an exact and immediate relation to the soil. The large amount of nitrates necessitates the tobacco being grown on a rich or freely manured soil. We have purposely passed over the ordinary organic materials of all vegetable matter, cellulose, albumen, resin, and gum. The combustion of these materials would result in an unfavourable or objectionable flavour, and the art of the manufacturer is to get rid as far as possible of these substances, or by fermentation to convert them into aromatic oils. This process is aided by the addition, during the maceration, of saccharine substances, liquorice, or alcohol. The first and most important step in this direction is the removal of the mid-

rib, so as to get rid of superfluous cellular matter. The practice of adding saccharine substances prevails all over the world; and a somewhat curious modification of this exists in India, where the pulp from the pods of *Cassia Fistula* is added to the tobacco smoked by the Hindus, along with numerous aromatic spices.

The chemistry of tobacco thus suggests an important fact to the cultivator, and affords a key by which the time-honoured method of manufacturing tobacco is justified. There is perhaps no more patent fact than that it is practically immaterial what seed be used; it is the chemistry of the soil that can alone ensure good tobacco. Not only does the tobacco raised in one country differ from that obtained in another, from the self-same seed, but this variation may be as great between the produce of one field and another within the same district. It is the merit of one country to produce mild and aromatic tobacco, of another strong tobacco, and even with the most careful manuring it may not be possible to overcome these distinctions.

V. The cultivation and manufacture of tobacco.—The tobacco plant requires a light sandy loam soil containing a fair amount of organic matter. Excess of organic matter produces a very heavy crop, but the leaves are coarse, and there is a deficiency in aroma. The land should be well drained. As we have shown, the plant contains a large portion of mineral constituents, which it extracts from the soil; there must accordingly be an abundant supply of potassium and calcium salts. The quality of a cigar, as judged by the smoker, depends greatly on the circumstance whether the tobacco burns well or not; and it is often recognised that cigars containing little nicotine, but burning badly, are more narcotic in their effects when smoked than well-burning cigars, though these may contain much nicotine. The good burning qualities of tobacco depend largely upon the presence of potassium, combined with vegetable acids and potassium nitrate. It is therefore of the first importance, either that the soil in which the tobacco plant grows should contain these salts naturally in abundance, or that they be added in the form of manure. It is remarkable that some of the best qualities of tobacco are produced in climates where the circumstances are favourable to the production of organic salts of potassium as well as of nitrates. Although there are instances of the successful cultivation of tobacco for many successive years on new land, a rotation of crops is generally recommended. Cereals are well adapted for this purpose, as tobacco removes but little phosphoric acid.

It may be affirmed broadly that good tobacco-leaf must not contain an excess of albumen (since that substance produces a rank and disagreeable flavour on burning), and that it must contain potash combined with vegetable acids in certain proportions to the nicotine and concrete volatile oil.

The preparation of the seed-bed is a matter of very considerable importance. It should be in a warm situation, very rich in manure, and the soil in a fine state of division, and not liable to cake. The transplanting takes place about seven or eight weeks after the sowing of the seed, and should be performed in the cool of the evening, or on a cloudy day. The soil must be kept at first in a moist condition and free from weeds, and the plants must be carefully watched for grub.

The flowering commences about two months after planting, and the

buds are then generally broken off. This increases the size of the leaves, but deteriorates their quality. At the end of about three months the plant is ripe, and the leaves are collected. A very mild tobacco, suitable for cigarettes, is however produced by picking the top or most tender leaves before they are quite ripe. Climate is a most important condition, affecting the quality of tobacco; and this condition has not hitherto been found apart from tropical or semi-tropical countries. The West Indies have always been famous for producing a tobacco more rich in aromatic principle than that grown in most other countries, and this is largely due to their possessing a climate both warm and moist. Hitherto all attempts at producing a leaf possessing the peculiar aroma of the Havana variety in parts of the world other than the West Indies have been unsuccessful. In certain parts of India and Ceylon, however, a cigar leaf is grown which may develop into a formidable rival to that of the West Indies; but at present, owing probably to the excessive amount of potassic nitrate found in the soil, the flavour is in this country regarded as coarse. In India itself the cigars are much appreciated, and are said to affect the head far less than the Havana. They in fact approach much nearer to the Manilla than to the Havana cigars.

In the Colonies cigars are made almost entirely by hand, and in England the same rule prevails in regard to the best qualities; but the poorer sorts are formed in moulds. The chief advantage of the better mode of manufacture is that comparatively little skill is required in forming the cigar into the necessary shape, and it can be done by young girls possessed of but little experience. The drawback is irregularity in the compression of the cigar, and consequently uncertainty in the burning. These cigars are generally made of the more common leaf, viz. German fillers with Japan or Java covers or wrappers, and they enter into competition rather with smoking or pipe tobacco than with foreign cigars. In the manufacture of the latter the West Indian and other Colonies possess the advantage of being the owners of good raw material, and if the quality can be improved, or even maintained, there is every reason to expect a prosperous future. It is hardly creditable to Britons over the sea that they should be so largely dependent on Manilla and Sumatra for supplies of cigar wrappers, and that the best cigars in Britain should be of foreign origin. As soon as the cigars are formed they go to the sorter, by whom they are classified according to colour. They are then tied in bundles, forced into boxes, and set to dry in a warm room. The English cigar manufacturer has to lose the interest on the duty from the time the leaf is taken out of warehouse until the cigars go into consumption. He has also to go to the expense of grinding his stalks, which are practically worthless as an article of commerce, before he can obtain a return of the duty paid upon them. There are few articles of daily consumption so free from adulteration as the cigar. Attempts have been made to imitate the well-known Havana flavour by artificial means, but the result has not been very satisfactory.

The manufacture of pipe tobacco for English consumption is, with the exception of a few fancy sorts, entirely in the hands of British manufacturers. Very little skill is required in this trade, but great ingenuity has been displayed in the various machinery for saving labour, both in cutting and spinning. It may be remarked that Australia and the Cape are both

quite abreast of England in the adoption of machinery. In the United Kingdom the law does not permit the use of any ingredient except water and acetic acid in cut tobacco; and water, acetic acid, olive oil and essential oil, for flavouring, in roll and cavendish. A few years ago a strong demand set in in favour of highly-flavoured tobacco and smoking mixtures, composed of flavoured cut-cavendish, and ordinary cut tobaccos were largely used. This demand has now become considerably modified. Twenty or thirty years ago the working classes in this country for the most part smoked cut tobacco. The fashion may now be said to have changed in favour of roll; this is due largely to a somewhat unfortunate competition which set in a few years ago. For a considerable time the retail price had not varied, and the public had become accustomed to it. When circumstances absolutely required an advance in price, certain traders endeavoured to meet the difficulty by causing the leaf to absorb more water. The competition then really became one as to how much water tobacco-leaf could be made to absorb; and, inasmuch as a rich leaf was more liable to decompose in the presence of water than a poor one, the latter came largely into use. In the meantime a few large manufacturers continued to maintain their quality, and raised their prices; and to protect themselves, sent out their cut tobacco in packages bearing their own labels. The result was that this class of tobacco became a favourite amongst the middle and lower-middle classes, and cut tobacco, apart from that sold in manufacturers' packages, has been largely superseded by roll. Formerly cut tobacco was confined almost exclusively to three classes, viz.: (1) Bird's-eye, which was generally understood to represent a light leaf, and included the stem; (2) Returns, generally prepared from the same leaf with the stem removed; and (3) Shag, generally prepared from a darker leaf, and subjected to a slight amount of sweating or fermentation. These three names are still continued in the trade, but manufacturers have for the most part adopted fancy ones. Public taste changes in the most unaccountable manner in regard to these brands; and when unequivocal success has been achieved for any one, it appears to be the chief aim of every other manufacturer to imitate as nearly as possible its name, price, and quality. A considerable demand prevails for flake tobacco, which only differs from ordinary cut in being pressed into a cake before being placed in the cutting-machine. This causes it to appear in uniform lengths, and it is frequently packed in boxes and used for cigarettes.

The manufacture of roll and cavendish has undergone a complete change within the past twenty years. The old mode of manufacture consisted in placing the cake or roll in an open press at ordinary temperature for a month or two, when it assumed the well-known dark colour which distinguishes it. Now the roll or cake is subjected to heat in the press, and two or three days are sufficient for the process.

American leaf is for the most part used in the preparation of pipe tobacco, and it is remarkable that in every case it is the product of a milder climate than that from which we obtain our cigar sorts. This would lead us to look to Australia and the Cape Colonies for the future supplies of this class of tobacco. At present the cultivation in these Colonies may be said to have hardly got beyond the experimental stage, but there are not wanting many hopeful signs in regard to the future.

The consumption of cigarettes as yet gives no indication of abatement. Originally confined to Turkish and light Virginian, they may now be said to embrace nearly every description of tobacco; and such is the ingenuity displayed in the machinery by which they are manufactured, that about two hundred and fifty cigarettes per minute can be turned out completely finished by one machine.

The demand for snuff has declined of late years, and this has no doubt discouraged the working out of new ideas. The chief manufacture is in the hands of well-known firms, and a considerable quantity is exported. The stems or mid-rib of smoking or pipe tobacco-leaf are utilised by the snuff manufacturers, but the stems of cigar-leaf are regarded as almost worthless for their purposes.

INDIA.

Tobacco and Cigars.

From Trichinopoly: Messrs. R. Ethirajulu Bros.; T. B. Mulusawmy, Mudalior Pillais; T. M. Mariya Pillay & Bros.; M. Cupanna, Pillay Bros.; T. M. Subramanid, Pillay & Co.; P. N. Ammia, Pillay & Co.; P. Narrainsawny Pillay. From Calicut: Messrs. J. Henke & Co. From Madras: Messrs. Oakes & Co.; Parthasarathy Naidu. From Coconada: Messrs. Roberts & Co.; Director of Agriculture, British Burmah; Director of Agriculture, Bombay; Dewan of Kolapur; State of Sangli; Desai of Nadiad; Butarde Veharidal; Messrs. Begg, Dunlop & Co.

Leaf.—Though some of the samples were of very good quality, there is still room for improvement, chiefly in curing and packing. A great number of samples were regarded as being almost unsaleable on account of hard packing and their objectionable odour. Some were perforated and broken, and in many cases rotten owing to imperfect curing.

Cigars.—Some of the cigars, notably the "Trichy" and the "Burma," were pronounced excellent. The ash remained firm, and the cigars had the reputation of not affecting the head one half as much as many of those sold in the London market. The evil of hard packing was again to be observed in many specimens. Some are filled right through, and in consequence can be tightly pressed; as a result they are heavy and difficult to smoke.

CANADA.

Tobacco and Cigars.

FORTIER, J. M., Montreal, Quebec.—Cigars.
FOUCHER, F. A. M., Montcalm, Quebec.—Quebec Tobacco.
HICKEY & STEWART, Charlotte Town, Prince Edward's Island.—Tobacco.
JOLIETTA, CANADIAN MANUFACTURING Co., Quebec.—Quebec Tobacco.
PELOQUIN, C.—Tobacco.
REID, GORING, & Co., Hamilton, Ontario.—Cigars.
RILEY, T. B., Charlotte Town, Prince Edward's Island.—Tobacco.
TASSÉ, WOOD, & Co., Montreal, Quebec.—Cigars.
TUCKETT, G. E., & SON, Hamilton, Ontario.—Plug and Cut Tobacco.

The various samples of Leaf Tobacco shown were of too deep a red in colour, and seemed to be totally devoid of the characteristic aroma that ought to be found in good tobacco. The samples were well selected, scarcely any stalk being present. These tobaccos, though unsuitable for the making of cigars, might be utilized for making shag. The pale cakes of manufactured tobacco were not suitable for the English market.

NEW SOUTH WALES.

Tobacco.

BROWN, E. G., Tumut.—Tobacco Leaf.
EMERY, D. J., Tumut.—Tobacco Leaf.
SNODDON, A., Tumut.—Tobacco Leaf.

SUTTON, A. W., & Co., Sydney.—Five Samples Tobacco Leaf, grown in New South Wales.

The samples of Leaf shown here were badly broken, and rendered almost useless by careless packing. One or two seemed to be fairly good, but not suited for the English market, owing to their high colour and defective fermentation.

VICTORIA.

Tobacco and Cigars.

FERGUSON, J., Bowman's Forest.—Tobacco and Leaf.
JACOBS, HART, & Co., Melbourne.—Cigars.

The manufacture of Cigars here shows great progress. They were well and carefully made, due attention being paid to the selection of the leaf. They were quite up to the British standard, and were a highly creditable exhibit.

SOUTH AUSTRALIA.

Tobacco and Cigars.

ARMBRUSTER & UHLMANN, Rundle Street, Adelaide.—Tobacco and Cigars made in the Colony.
DIXSON, ROBERT, & Co., Light Square West, Adelaide.—Manufactured Tobaccos.

The manufactured Tobaccos exhibited here under the name of Dickson were very creditable, the Cavendish being especially good. It was one of the best samples to be found in the Exhibition. The Cigars were quite up to the average qualities of British make.

QUEENSLAND.

Tobacco.

HOCKER, J. H., Brisbane.—Queensland-grown Tobacco, raw and manufactured.
TYRELL, MRS. J. DE POIX, Stanthorpe.—Tobacco Leaf.

The samples shown were of a fairly average quality.

FIJI.

Tobacco.

MASON, HON. J. E.—Leaf of Tobacco.
THE PROVINCE OF COLO EAST.—Leaf of Tobacco.

These Tobaccos had evidently been reared from a bad stock. Although they were superior in both colour and aroma to some forms of Indian Tobaccos, they were not suitable for cigar making, owing to the venation of the leaf, which in some instances is too square and in others too acute.

CAPE OF GOOD HOPE.

Tobacco.

MASON, G. J., Balfour.—Tobacco, grown in Stockenstrom district.
OUDTSHOORN CHAMBER OF COMMERCE.—Tobacco.
POCOCK, A. A., Oudtshoorn.—Tobacco.
PRINCE, VINTCENT, & Co., Mossel Bey.—Leaf Tobacco, grown in Oudtshoorn district.
VAN WYK, STEPHANUS JOHANNES, Vergelegen, Oudtshoorn.—Samples of Tobacco of various kinds, grown at Vergelegen.
JOSEPH & GLUCKSTEIN, Victoria West.—Manufacture of Cape Tobacco.

The Leaf Tobacco exhibited in this section consisted of some of the best in the whole Exhibition, being well selected and carefully cured. It was of a good colour, and suitable for the making of inferior cigars. That exhibited by Van Wyk was a kind of nondescript, being neither light nor dark in colour, and having no flavour or aroma. The samples exhibited by Messrs. Mason & Schoeman were of a similar kind. Mr. Pocock's samples are fairly good, both in flavour and colour. Mr. Bolta exhibited samples of a fine light colour, which could be used for making shag. Though they did not possess much flavour, they were the best exhibited in the Cape Court. Messrs. Prince & Co.'s samples were of a similar quality.

NATAL.

Tobacco.

BISSET, GENERAL SIR J. J., K.C.M.G.—Leaf Tobacco.
NICHOLSON, W., JUN., Richmond.—Roll Tobacco.
REID & ACUTT, Durban.—40 lbs. Loose Cut Transvaal Boer Tobacco, Koodoo Brand; price 8*d.* per lb. 50 lbs. Cut Transvaal Tobacco, Koodoo Brand; price 10*d.* per lb. Ten 5-lb. bags, Koodoo Brand; price 9*d.* per lb.
BROWN, Riet Valley.—Leaf Tobacco.
KING, FRANK, Ladysmith.—Rolls of Tobacco.

The quality of this Tobacco was good, and the flavour well preserved. With proper care being paid to the fermentation, it would be first-class tobacco, and very similar to Virginia; in fact, with a little more gum, it would be difficult to distinguish it from Virginia. Although not a cigar, it would make a very good Cavendish tobacco. The native rolls are much too thick. They are made by the Boers and Kaffirs from plants grown in their gardens. Natal has nearly the same latitude as Richmond, lat. 35° S. equalling 39° N.

CEYLON.

Tobacco and Cigars.

GOVERNMENT OF CEYLON.
INGLETON, J. K.
PILLAY, RANGASAMI.

The samples exhibited in this Court were all deficient in aroma; that marked "Jaffua" was rendered useless through the large quantity of stalk it contained. The best prepared leaf, whilst suitable for the manufacture of cigars for India and Ceylon, would not do for the English market. All the samples were badly cured and deficient in flavour. They were similar in quality to those of Calcutta, and a few years ago could be bought at the low rate of one halfpenny per pound. They contained no gum, nor substance, but were entirely deficient in flavour.

MAURITIUS.

Tobacco and Cigars.

LIENARD, C.—(1) Cigars. (2) Tobacco in Leaves.
D'UNIENVILLE, P.—(1) Tobacco in Leaves. (2) Carote of Tobacco.
MAMET.—Carote of Tobacco.

The Tobaccos shown here were of a very inferior order. One sample appeared to have undergone decomposition; and though a second seemed to be of a fairly average quality, it was quite unsuited for cigar making.

STRAITS SETTLEMENTS.

Tobacco and Cigars.

GUTHRIE & Co., Singapore.—Tobacco.
LUNEBERG, Penang.—Cigars and Cigarettes.
WESTERHOUT, J. E., Malacca.—Tobacco.

The short thick Cigars made in these Settlements scarce deserve more than a passing consideration. Their Chinese character and peculiar flavour preclude them entirely from any possible European trade. The Tobacco of which they are made is however admirable, but it is feared that it is imported, and not grown in the Straits.

BRITISH NORTH BORNEO.

Tobacco.

BRITISH NORTH BORNEO CO.—Raw Tobacco.

The specimens were of a very superior quality, both in aroma and appearance. They are well adapted for cigar making, and were considered amongst the best in the Exhibition.

BRITISH GUIANA.

Tobacco.

The Tobacco here is made up into large cigar-shaped rolls, and enclosed in plantain leaf. It seemed to be of good quality, and was carefully cured. Owing to the compressed manner of packing, however, it was rendered quite useless for the British market.

WEST INDIES, &c.

JAMAICA.

Cigars.

The Cigars here manufactured are of a very good appearance, carefully selected, and of a very good colour. Taken altogether, the tobacco is as good as Havana.

TRINIDAD.

Tobacco and Cigars.

FABIEN, C. A.—Cigars, manufactured and unmanufactured Tobacco.
ST. HILL, T. J.—Cigars and unmanufactured Tobacco.
VOTOR, MRS.—"Long Tom" Cigars.

The Cigars manufactured here are of a very good appearance, carefully selected, and of a good colour, and taken throughout, the Tobacco is as good in quality as Havana. Some were made up into somewhat peculiar shapes, such as the "Long Tom" Cigars, and others. The sample marked 105 B, though inferior looking, had a good deal of flavour. They were rather short, and would require a sweet filler, being more like Cavendish. The leaves were not properly wrapped round, and required liquorice to bring out the gloss. The sample 105 E was fairly flavoured, and of the Havana type.

WINDWARD ISLANDS.

GRENADA.

Tobacco.

FREELING, SIR S., K.C.M.G.—Tobacco grown on the Annandale Estate from seed imported from Java by W. B. Lindsay, Esq.
BARNES, ISAAC S.—Two samples of Tobacco.

The Leaf shown here was remarkably thin, but seemed good in quality, and was suitable for cigar manufacture.

ST. LUCIA.

Tobacco and Cigars.

The Tobacco Leaf here might be manufactured into a saleable article, providing more care was taken in the cultivation and curing. The Cigars manufactured from it were of a very inferior quality, and possessed no flavour.

LEEWARD ISLANDS.

ANTIGUA.

Tobacco and Cigars.

The Tobacco grown here is of a fair average quality, but the Cigars manufactured are only suitable for local consumption.

DOMINICA.

Cigars.

The Cigars manufactured here are like those of Antigua, only suitable for local consumption.

BRITISH HONDURAS.

Tobacco and Cigars.

The Leaf here exhibited by H. A. Wickham is of a rich colour and very good quality. It was fully equal to any shown in the Exhibition. The Cigars were of fair quality, but the fillers have not been properly put in.

BAHAMAS.

Cigars.

The Cigars from here have been very much admired, and were of a superior quality, quite equal, and, in some cases, superior to the Havana.

MALTA.

A sample case of fancifully dried botancial specimens, in which care had evidently been taken to select the smallest leaves for exhibit. Upon reference to the office in the Court, no information could be obtained as to whether the said samples were grown in Malta or not.

GENERAL NOTE.

When seed is imported, a mongrel crop is produced the first season, partly flavoured with the soil. In the second year the crop is truer to the seed. The leaves keep in better preservation when ripe. They should not be green nor dead, nor should they be left open, but pressed to preserve the flavour. Stalks should never be sent with tobacco, since they raise the cost, show carelessness, and would be more useful as manure, as they contain much potash and saltpetre, which retain moisture.

DRUGS, CHEMICAL AND PHARMACEUTICAL PRODUCTS.

By Dr. B. H. PAUL, F.C.S.

THE number of articles shown in the Colonial sections of the Exhibition which came under the general designation of drugs was so considerable, even when adopting the more limited application of the term to articles employed for medicinal purposes, that in reporting upon them it will be convenient, in the first place, to refer only to those drugs which are comprised in the *materia medica* of the British Pharmacopœia. Though comparatively few of these are the natural produce of British Colonies, the cultivation of some important official drugs has within the last few years been introduced into one or other of the Colonies, and hence these drugs constituted special features of interest among the exhibits. Thus, for instance, cinchona bark was shown in several of the Colonial Courts, opium in the Victoria Court, cardamoms in the Ceylon and West Indian Courts, jalap in the Jamaica Court, and olive oil in several of the Australian Courts.

Some of the articles thus exhibited as naturalised Colonial produce are employed not only for medicinal purposes, but also as the raw material of various industries, or as articles of food; but it will be unnecessary to deal with any of them in those relations, since they will form the subjects of other reports. It may, however, be pointed out here that however beneficial it may be to develop the natural capabilities of the Colonies by the cultivation of produce for which we should otherwise be dependent upon foreign countries, the production of such articles as are used only for medicinal purposes must always be confined within narrow limits as compared with articles of more general consumption, if the result is to be of such a nature as to prove remunerative to the producers. It may be to some extent desirable to reduce the cost of drugs, but as the consumption cannot be thereby very materially augmented as a rule, this fact should not be lost sight of.

Cinchona Bark.—A number of fine samples of this very important drug were exhibited in the Ceylon Court especially, and also as the produce of cultivation in Jamaica, Mauritius, Fiji, and the Straits Settlements. In addition to the interest attaching to it intrinsically, as one of the chief articles of the *materia medica* of all countries, the fact of its having been grown successfully in these British Colonies is deserving of notice from a commercial point of view. The introduction of cinchona cultivation into Ceylon was an off-shoot of the great experiment undertaken by the Government in India, and the success with which it has been attended, so far, in that island has been productive of very important consequences. At the time when this work was commenced, in 1861, the whole of the cinchona bark used in medicine and for the manufacture of quinine

was supplied from South America, and for some time after the experimental planting of cinchonas in Ceylon little attention was given to it by the planters; but subsequently, when the general failure of the coffee crop became serious, cinchona planting was had recourse to on many estates. Since then it has been extended so rapidly that, although in 1875 the quantity of bark exported from Ceylon was only 18,731 lbs., the quantity exported in each of the years 1884 and 1885 has amounted to upwards of eleven million pounds. The kinds of cinchona chiefly grown at the present time in Ceylon are the *C. officinalis* and *C. succirubra*, the latter being most in favour on account of its free growth, though the bark it yields contains a smaller amount of quinine, and this is always associated with a large proportion of the less valuable alkaloids cinchonidine and cinchonine. Some of the finer varieties of cinchona, such as that termed *C. Ledgeriana*, have yielded bark containing upwards of 10 per cent. of quinine, but this kind has been found less successful on account of its delicacy and the liability to canker. Many of the trees produced from seed in 1866 and 1867 were of a character intermediate between the *officinalis* and *succirubra*, as a result of natural crossing, and these hybrids being of hardy nature and vigorous in growth are termed *C. robusta*. When the extended cultivation of cinchona in Ceylon was first undertaken, it was anticipated that the demand for quinine would be so much augmented, by even a slight reduction in the price of bark, that considerable additional supplies of the raw material would be a great boon to humanity without causing any serious disturbance in the markets for bark or quinine. But this expectation has not been realised, and the result of the large imports of bark from Ceylon has been to reduce the price of bark and of quinine to less than one-fourth what it was four years ago. It is questionable whether this depreciation of the market value of these articles has been attended with any commensurate benefit to the consumers of quinine, and it has certainly had a very disastrous influence in several respects.

Some very fine samples of cultivated cinchona bark were also shown in the Jamaica Court. The growth of cinchonas in that island was introduced experimentally by Government in 1866, and upwards of 150 acres are now under cultivation. Some of the bark grown in Jamaica is of very good quality.

The succirubra bark grown in Mauritius was also exhibited.

In the Fiji Court samples of the same bark were exhibited; but the reduction in the price of the drug has entirely destroyed the prospects of a profitable return which its cultivation presented some few years ago.

In the Straits Settlements Court cinchona bark grown in Perak was shown, but though its quality has improved within the last few years, there is now but little probability of the cultivation being remunerative at present prices. It is remarkable that the bark from this Colony, though derived from calisaya species, presents an appearance very different from that of most calisaya bark, and resembles much more closely the bark of *C. succirubra*. The relative proportions of the alkaloids is, however, the same as is usually met with in calisaya bark, the quinine preponderating over the others.

The bark grown in Jamaica appears to present similar anomalies in regard to external character to such an extent that, while some of the samples of calisaya bark have all the appearance of succirubra bark,

the samples marked succirubra often present the generally characteristic appearance of calisaya bark.

Opium.—A very fine sample of this drug was exhibited in the Victorian Court, closely resembling in appearance the better kinds of Persian opium, and containing 10 per cent. of morphine. The production of opium in Victoria is scarcely of commercial importance, as it is protected by a heavy duty on imported opium, and is still insufficient to supply the local demand. Moreover, from the necessity for the command of low-priced labour in the collection of opium, it is doubtful whether there is much prospect of successful competition with the opium produced in Persia, Turkey, and China.

Aloes.—In the West Indian Court a sample of the aloes produced in the island of Barbados was exhibited, and another from Antigua.

In the Cape of Good Hope Court samples of the aloes known in commerce as Cape aloes were shown. The best kind is stated to be the produce of *A. ferox*; that obtained from *A. Africana* is not so bitter or so powerful. The aloes used by the Colonists is obtained from *A. plicatilis;* it resembles Barbados aloes, and is a much milder purgative.

In the Natal Court samples of aloes were exhibited under the name of "Socotrine aloes," similar to the aloes now known in commerce by this name, but differing from the aloes of Socotra in external characters.

Senna was exhibited in the Cape of Good Hope Court, the produce of a variety of *Cassia obovata*, and differing from the official drug. This kind of senna was formerly grown in Italy for medicinal use; it is plentiful throughout the Hopetown district at the Cape, and if it proved of commercial value, an unlimited supply could be obtained.

Buchu Leaves, the natural produce of the Cape of Good Hope, were exhibited in the Court of that Colony. Some varieties which are highly prized at the Cape differ from the official drug, which is obtained from the three species *Barosma betulina*, *B. crenulata*, and *B. serratifolia*.

Sarsaparilla was exhibited in the Jamaica Court as the produce of *Smilax officinalis*, but differing from the drug known in commerce as Jamaica sarsaparilla, which is not really the produce of Jamaica, but bears that name only because it was formerly shipped from Central America by way of that island. The sarsaparilla grown in Jamaica differs from it in being paler in colour, and so much more amylaceous that it finds but little favour in the English market. Samples of native sarsaparilla were also shown from Trinidad, St. Vincent, Tobago, and Montserrat, and the sarsaparilla of British Honduras was shown in the Courts of that Colony and British Guiana.

A drug exhibited in the Western Australian Court under the name of sarsaparilla was described as growing plentifully in the swamps adjacent to the coast. It is quite different from the ordinary drug, but is used locally to prepare a decoction like that made from the sarsaparilla of commerce. Native sarsaparilla was also shown in the New South Wales Court.

Nux vomica Seeds were exhibited in the Courts of Ceylon and Trinidad, those from Ceylon being noticeable as containing a larger amount of strychnine than the seeds from other sources.

Jalap Root, the cultivation of which has been introduced into Jamaica,

was exhibited in the Court of that island; but it does not appear to have realised the expectations that were entertained.

Calabar Beans were exhibited in the Courts of Ceylon and the West African Colonies.

Gamboge was exhibited from Singapore and in the Ceylon Court, and though little has been yet done in Ceylon towards developing this product commercially, it is said to be of excellent quality.

Bebeeru Bark, the natural produce of British Guiana, was exhibited in the Court of that Colony, and also from Dominica, where the tree producing it is found abundantly.

Casscarilla Bark, the natural produce of the Bahamas, was shown in the Courts of these islands, Montserrat and Jamaica.

Canella Bark, the natural produce of the West Indian islands, was exhibited in several of the Courts in that section.

Quassia Wood, the produce of *Picræna excelsa*, the kind now official, was exhibited in the Jamaica Court. Samples of the wood of *Quassia amara* were also shown in this Court, and those of British Guiana, St. Vincent and Tobago.

Hops were exhibited in the Courts of Canada, Victoria, New Zealand and the Cape of Good Hope, having a fine aroma and good colour.

Logwood.—The produce of *Hæmatoxylon Campechianum* was exhibited in the Court of British Honduras. This tree forms immense thickets in marshy places in that Colony, and the wood is an important article of export, chiefly for use as a dye-stuff, and also to some extent for medicinal purposes as an astringent. There are two varieties, one with a broad leaf, which is most valuable on account of the solidity of the wood and its yielding a larger amount of colour, the other smaller leafed variety is however said to yield a dye of better quality.

Camphor was exhibited only in the Straits Settlements and British North Borneo Courts, but was not that kind which is official, though probably worth examination as to its medicinal value, as it is preferred by the Chinese to the cheaper camphor of Japan and China.

Copaiba Balsam was exhibited in the British Guiana Court. All the samples were of good general character; but the drug from this source does not appear to have been yet introduced here commercially.

Catechu was exhibited in the Straits Settlements Court, both as cubes corresponding with the official drug, and in thin cakes which appeared to consist of more carefully prepared material.

Tobacco, which was exhibited in the Courts of Canada, New South Wales, Victoria, South Australia, Queensland, Fiji, Cape of Good Hope, Natal, British North Borneo, Ceylon, West Indies and British Honduras, forms the subject of a special report.

Cardamoms of the official kind were exhibited in the Courts of Ceylon, Jamaica and Grenada. In Ceylon, cardamoms of two kinds are cultivated, the ordinary Malabar kind and the Allepey, or, as it is commonly called, Mysore cardamom. The former is the most productive under favourable conditions, and it is now an article of considerable commercial importance in Ceylon. There is also a wild cardamom, indigenous in Ceylon, which differs from the official kind. The round cardamoms exhibited in the Straits Settlements Court were the produce of *Amomum cardamomum.*

Cinnamon was exhibited principally in the Ceylon Court, and the samples

were of fine quality. That shown in the West Indian, Fiji and Sierra Leone Courts was generally inferior; but that from St. Lucia, though thick and coarse, possessed considerable aroma.

Cloves were exhibited from the Seychelles, Ceylon, St. Lucia and Dominica. Oil of cloves of very good quality was also shown in the Seychelles Court, prepared from green cloves, dried cloves, and clove stalks.

Nutmegs were exhibited in the Ceylon, Jamaica, Grenada, St. Vincent, St. Lucia and Dominica Courts. The nutmegs shown in the Fiji Court were quite destitute of taste or smell.

Pepper was exhibited in several of the West Indian Courts, also from British Honduras, British North Borneo and the Straits Settlements.

Pimento was exhibited in the Ceylon and Jamaica Courts, that from St. Lucia was the produce of *Pimenta acris.*

Ginger was exhibited in several of the West Indian Courts, but the samples were generally of inferior quality and in bad condition. This was also the case with the samples of ginger from the Gold Coast, Sierra Leone and the Straits Settlements.

Gum arabic.—A large number of samples of gum resembling more or less that known under the above name were exhibited in the Australian and West Indian Courts, as well as in the Cape of Good Hope and West African Courts. Most of them were either inferior in colour and solubility, or of a character similar to Bassora gum. The best sample was one from South Australia, and some of those in the West African Courts, though very mixed, contained a large proportion of good, clear, colourless gum.

Beeswax was exhibited in several of the Australian Courts, that of New South Wales being almost colourless, and the samples from Western Australia very good. The supply of beeswax in the virgin forests of British North Borneo is enormous, and it forms a considerable article of export, though only a small portion of it is collected. The wild bees usually build in very tall trees, and the work of collecting the nests is both difficult and dangerous.

Honey was exhibited in many of the Courts. That from the Province of Ontario in Canada was of remarkably fine quality, and the business of bee-keeping appears to be carried out in the Colony upon a very large scale. Three kinds of honey were shown, called thistle, clover and linden, the latter having a very delicate flavour. Good honey was also exhibited from New South Wales, Queensland, New Zealand and Western Australia. Bees were imported into the latter Colony within the last twenty years, and they have multiplied to such an extent that they are now to be found over a very large area of forest land and scrub as far as 150 miles eastward from Perth. Owing to the abundance of flowering trees and shrubs rich in honey, the bees are never in want of food at any time of the year, so that there is every probability the collection of wild honey and wax will become a lucrative pursuit.

In South Australia bee-keeping has become a considerable industry, which is carried on with all modern appliances under the auspices of a bee-keepers' association. Ligurian queen bees have been imported for the purpose of producing a superior strain of Ligurian bees, from which Australian bee-keepers can draw their stocks in future. Some fine samples of honey were exhibited in the Court of this Colony.

Honey was also exhibited in the West Indian, British Guiana, Cape of Good Hope, Straits Settlements and Malta Courts.

Raisins of very excellent quality were exhibited in the Cape of Good Hope and Australian Courts, and though, as an article of the *materia medica*, the consumption is but small, their import from those Colonies for other purposes would probably be remunerative.

Castor oil was exhibited in most of the West Indian Courts, also in the South Australia, Ceylon, British Guiana, Fiji and Seychelles Courts, that in the latter being of very good quality, clear and brilliant. The seeds from which this oil is extracted were also exhibited in many of the Courts.

Olive oil was exhibited in the New South Wales, South Australian, Victoria and Western Australian Courts. Several of the samples were of very excellent quality; but some retained the harsh astringent taste of the olive in a marked degree, probably in consequence of some defect in the manufacture. In South Australia the cultivation of the olive has been prosecuted with great energy. As far back as 1851, samples of the oil shown at the great Exhibition in London obtained honourable mention, and since that time considerable advance has been made, the nature of the soil and the warm dry climate of South Australia being especially favourable to the growth of the olive tree and the maturing of its fruit. This and the other Australian Colonies ought therefore to become sources of olive oil, and its production an object of commercial importance to them.

Mutton suet.—This article of the *materia medica* was exhibited in most of the Australian Courts as a product of the meat-preserving factories, but like several other fats and oils exhibited, is of importance rather in relation to the applications of soap- and candle-making.

Lime-juice was exhibited in most of the West Indian Courts, as well as the Natal and Fiji Courts. In a concentrated state containing about 100 ounces of citric acid to the gallon, it forms a staple export from Dominica, Montserrat, and some of the other islands.

Alcohol in the form of rectified spirit, 0·818 sp. gr., was exhibited in the Courts of South Australia and Natal. Both samples were very good.

Vinegar was exhibited in the Courts of several of the wine-producing Colonies of Australia, the Cape of Good Hope and Cyprus, and in that of British Guiana a sample made from the juice of the sugar cane was shown. Some of these samples described as wine vinegar had evidently been prepared from acetic acid by dilution with water; but others presented all the characters of good vinegar made from wine or an infusion of malt.

Besides the articles above referred to, there were in the Exhibition a very large number of drugs having local repute as medicinal agents in the several Colonies where they are produced. Some few of these have already been made the subject of chemical and physiological study, as, for instance, the bark of *Alstonia constricta*, and pitury (*Duboisia Hopwoodii*); but of most of these drugs little or nothing is known as to their constituents or therapeutic effects.

In the New South Wales Courts were samples of sassafras bark (*Doryphora Sassafras*) containing a volatile oil and a bitter substance; hickory bark (*Acacia falcata*) containing a considerable amount of tannin, and used by the aborigines for poisoning fish and for the cure of skin-diseases; bitter bark (*Tabernæmontana orientalis*) used, in the form of decoction, as a tonic; and fever bark (*Alstonia constricta*) used in the same

manner. A large collection of various kinds of gum, chiefly from species of eucalyptus, were shown in this Court, and though most of them have not yet been applied to any useful purpose, they present characters which appear to render some trials in this direction desirable.

Some of the varieties of wood exhibited in this Court are fragrant: that of *Acacia pendula*, for example, having a violet odour, *Dysoxylon Fraserianum* rose scented; these as well as *Acacia homalophylla* and *Daphnandra micrantha* might be used for obtaining essential oils by distillation that would be applicable for perfumery.

In the Victoria Court a number of essential oils obtained from various species of eucalyptus were shown which would be useful as perfumes in the manufacture of soap, that of *E. citriodora* being very similar to citronelle oil. The bitter constituent of eucalyptus termed eucalyptin is said to be useful as a febrifuge. In this Court also there were a number of gums and resins obtained from varieties of eucalyptus and the grass trees, some of which appear to be susceptible of application in the manufacture of varnishes. The bark of *Atherosperma moschatum* shown in this Court, contains a substance which has a marked influence in lowering the action of the heart and is deserving of closer examination as to its therapeutic uses. The flowers of the golden wattle (*Acacia pycnantha*), of *Boronia Megastigma*, and *Pittosporum undulatum* yield fragrant oils that would be useful in perfumery. Oil of lavender and oil of peppermint, both of good quality, were shown as the produce of Victoria. The sandal-wood oil obtained from the wood of *Fusanus spicatus* has an agreeable fragrance, and differs but little from the oil of *Santalum album* in general character. The gum sandarac produced in this Colony from a species of *Callitris* in great abundance appears to be an article that would be useful to varnish-makers, as it is almost identical with the best sandarac from Northern Africa. The oils of *Melaleuca ericifolia* and *M. parviflora* closely resemble the cajeput oil of *M. leucadendron* imported from Singapore and Batavia, and would probably serve the same purpose as medicinal agents.

In the Queensland Court the exhibits comprised *Euphorbia pilulifera*, used as a remedy for asthma, Alstonia bark, Kamala, *Duboisia Hopwoodii* and *D. myoporodes*, various samples of eucalyptus oils, the oil of *Melaleuca leucadendron*, the oil of *Backhousia citriodora* and the oil of *E. Staigeriana*, both closely resembling in odour the oil of verbena. The various gums and resins obtained from the different species of eucalyptus and other Australian trees were also well represented in this Court. The bark of the Queensland sassafras tree (*Nesodaphne obtusifolia*) had been used as an astringent in dysentery and diarrhœa. The bark of *Achras laurifolia* has also been used for the preparation of an astringent extract for the treatment of throat-diseases. The bark of *Cinnamomum Tamala*, and of *Erythroxflon australe*, as well as the stem of *Piper Novæ-Hollandiæ* have also been employed medicinally in Queensland. Dugong oil from *Halicore Dugong* is recommended as a substitute for cod-liver oil.

In the Western Australian Court the exhibits of Eucalyptus and Xanthorrhea gums were numerous, and there were also some samples of gum resembling gum arabic; but they were not of very good quality. Sandal wood, the produce of *Fusanus spicatus*, is obtained abundantly in this Colony. A kind of sarsaparilla, which grows plentifully near the coast in swampy ground, was shown. It is used in the same way as ordinary

sarsaparilla. Another Queensland plant, known as native tea, was formerly used medicinally.

In the Cape of Good Hope Court there were several collections illustrative of indigenous drugs used in the Colony by the natives and Boers. Among these were *Osmitopsis asteriscoides*, a plant containing a large amount of volatile oil resembling camphor in odour, and probably allied to cajeput oil. Infused in spirit it is said to act as a powerful remedy when applied externally, as an embrocation in cases of paralysis. The leaves of *Bubon Galbanum*, an umbelliferous plant found all over the Colony, has a repute as a diuretic under the name of wild celery. A resinous exudation from the stem of this plant resembles the gum galbanum of the pharmacopœia.

The juice of *Hydrocotyle asiatica* has been recommended as a remedy for leprosy. The leaves of *Melianthus major* have been found serviceable in necrosis, and for promoting granulation in foul ulcers.

The roots and leaves of *Lichtensteinia interrupta* are used in splenic fever.

The root of *Sium capense* is renowned for allaying toothache when chewed.

Mentha capensis, growing abundantly in moist, mountainous districts, contains an ethereal oil which might be worth extraction.

Wild hemp (*Leonotis Leonurus*) is the Fuigo tribal remedy; this plant appears to have narcotic properties, and is used for smoking by the Hottentots. The decoction is a strong purgative. The plant is also used, like other species of Leonotis, as an antidote to snake-bite.

Cissus capensis is used in the form of decoction as a remedy for piles and dysentery.

The fruit of *Hyænanche globosa* is very poisonous, and is used to destroy wild beasts. It occurs only in one locality, known as the "poison mountain" in Clanwilliam.

Datura stramonium, originally a native of America, is now naturalized at the Cape, and is used for smoking, as well as in poultices to allay pain.

The berries of *Piper capense* resemble cubebs, and are used as a carminative.

Teucrium africanum is the tribal remedy of the Kaffirs; it is employed for snake-bites, glanders, ophthalmia, and to neutralize the injurious effects of eating the flesh of animals that have died of splenic fever.

For the treatment of ophthalmia similar properties are ascribed to *Lantana salviæfolia*.

A white crystalline substance, called proteacin, obtained from a species of *Leucadendron*, and closely allied chemically to salicin, was exhibited as being of value in the treatment of malarious fever.

Myrica cordifolia yields an excellent wax, which is used for candles.

The bark of *Acacia horrida* is used in fever and dysentery. This is the tree which yields the Cape gum, resembling inferior gum arabic. Another gum-yielding tree is the *Virgilia capensis*.

A substance was exhibited under the name of Euphorbia juice, which has some of the characters of caoutchouc, and it is suggested that it might be of use as a substitute for india-rubber, being very abundant in many parts of the Colony. It is used locally to destroy corns and as a blister. A similar substance was exhibited in the Natal Court.

The roots of *Tephrosia macropoda* are used in Natal, under the name of losaan, for killing fish and insects.

In the Ceylon Court the exhibits of non-official drugs comprised a large number of articles that are used in native medical practice, as much, if not more, on the basis of traditional repute than by reason of any ascertained definite properties. A very complete collection of these native drugs was exhibited, comprising 362 specimens, with the botanical as well as the vernacular names attached. Another collection of 89 specimens represented the indigenous native drugs of the western province of Ceylon, and a third collection of 170 specimens represented the Bazaar drugs imported into the island. Kola-nuts grown in Ceylon were also shown.

In the Straits Settlements several collections of native drugs and of Chinese drugs were shown. The root of the "Tuba" plant, *Derris eliptica*, is used for poisoning fish, and the active principle would probably be useful as an insecticide. This root is used as an ingredient of the arrow-poison used by the Malays. Another arrow-poison made from the Upas tree (*Antiaris toxicaria*), and used by the Sakeis, was shown in the Perak Section.

In the British Guiana Court a large number of astringent barks were exhibited, some of which are used in the Colony for medicinal purposes and as tanning materials, the bark of the black mangrove, *Rhizaphora mangle*, being one of the best for this purpose. The other kinds of bark used medicinally comprise Dacama bark, used in dysentery; "Sarababa," used as an emetic in fever; "Bocari," used as a stomachic; "Arecadako," used for snake-bite; "Arewewa," used as a purgative; "Kerecowa," used as an antidote to poisons; "Coutaballi," used in fevers; and "Mora," used in dysentery. Two barks said to be poisonous, and used for snake-bites, are named "Aramata" and "Coroo-coroo."

In the Jamaica Court the exhibits of native drugs comprise "chew-stick," the stems of *Gouania Domingensis*, which have a pleasant bitter taste, and contain a constituent similar to saponin. They are used as a substitute for tooth brushes. "Bitter dan" is the bark of *Simaruba glauca*, and probably resembles that of *Simaruba amara* in therapeutic effect. *Prunus occidentalis* is said to be used for flavouring noyeau, but according to Dr. Trimen that is not the case, the noyeau cherry of the West Indies being *Cerasus sphænocarpa*. "Majoe bitter" is the bark of *Picramnia antidesma*, and has been lately introduced into medicine in the United States under the name of "Honduras bark" or "Casca amarga." The bark of *Andira inermis* has long been known under the name of "bastard cabbage bark" as a powerful and somewhat dangerous anthelmintic. "Fitweed root," obtained from *Eryngium fœtidum*, appears to be a powerful anti-spasmodic. "Adrue," the rhizome of *Cyperus articulatus*, is said to be as efficacious as cinchona bark in the cure of remittent fever, and a decoction of it restrains the vomiting in yellow fever. It has lately been used in the United States. "Dogwood-root bark," *Piscidia erythrina*, has lately been recommended as a hypnotic in insomnia arising from mental worry, and as an anodyne in idiopathic neuralgic affections. "Balsam-tree bark" is probably the produce of *Amyris balsamifera*. "Wild worm-wood," *Parthenium Hysterophorus*, is the source of the alkaloid parthenine, said to be useful in the treatment of neuralgia. "Guinea hen weed,"

Petiveria alliacea, is extremely acrid. "Bocconia root," from *Bocconia frutescens*, a papaveraceous plant, has properties resembling those of *Chelidonium*, and is used for ringworm, warts, &c.

The medicinal drugs exhibited in the Trinidad Court comprised "Semen Contra," the produce of *Chenopodium ambrosioides*; "Liane tasso," the young branches of *Schnella excisa*, an astringent drug used in diseases of the kidneys; "Manioc chapelle," the roots of *Entada polystachya* and other species, containing saponin. "Fruita De Burro," the seed vessel of *Xylopia salicifolia*, used as an aromatic bitter stimulant; "Gully root," or "Stink weed," the root of *Cassia occidentalis*, used as a diuretic in dropsy; "Guatamare," the pod of *Myrospermum frutescens*, used as a carminative and stomachic, the tincture being also used externally to relieve pain. When the bark of this tree is incised, a balsam exudes that is said to be very similar to balsam of tolu.

In the St. Vincent Court noyeau bark and leaves (*Cerasus sphænocarpa*) and sapote seeds (*Lucuma mammosum*) were shown as the materials used for flavouring liqueurs. "Olivier bark" (*Chuncoa obovata*) is used like ipecacuhana in dysentery. "Snake wood" is used in the preparation of a native drink.

In the West African Courts a large number of native drugs were shown, and some among them would probably be worth further examination in regard to their composition and therapeutic effects; but so little is known respecting them that it would be of little use to refer to them more particularly.

The chemical products shown in the Colonial Sections of the Exhibition were comparatively few in number, and did not in any case appear to furnish an adequate representation of the extent to which chemical manufacturing operations have been developed in the several Colonies. Soap-making, which has been characterized by Liebig as affording a measure of the wealth and civilization of a country, was represented in several of the Courts, but, at the request of Mr. Leopold Field, this industry has been left for him to deal with in his report on oils, fat, &c.

In the Canadian Court chemical industries were represented chiefly by exhibits of salt, refined for dairy and table use, soap and manures of various kinds, petroleum products for burning and lubricating purposes, mineral paints, blacking, glue, varnishes, tanning and dyeing extracts, among which the extract of hemlock bark (*Tsuga canadensis*) constitutes an article of much importance for export. The manufacture of aërated water of various kinds was also well represented.

In the New South Wales Court the chemical industries represented were soap- and candle-making, the manufacture of kerosene oil from shale, animal oils, blacking, baking-powder, aërated waters, vinegar, and other articles of domestic use; but there was an absence of exhibits illustrating other important chemical industries.

In the Victoria Court the exhibits of this class were of a similar nature, comprising soaps, soda crystals, disinfectants, candles, animal fats, glue and aërated waters.

In the Courts of South Australia, Queensland, Western Australia and New Zealand the exhibits of chemical products were also of a similar description.

In the Fiji, Cape of Good Hope, and Natal Courts the chief chemical

The roots of *Tephrosia macropoda* are used in Natal, under the name of losaan, for killing fish and insects.

In the Ceylon Court the exhibits of non-official drugs comprised a large number of articles that are used in native medical practice, as much, if not more, on the basis of traditional repute than by reason of any ascertained definite properties. A very complete collection of these native drugs was exhibited, comprising 362 specimens, with the botanical as well as the vernacular names attached. Another collection of 89 specimens represented the indigenous native drugs of the western province of Ceylon, and a third collection of 170 specimens represented the Bazaar drugs imported into the island. Kola-nuts grown in Ceylon were also shown.

In the Straits Settlements several collections of native drugs and of Chinese drugs were shown. The root of the "Tuba" plant, *Derris eliptica*, is used for poisoning fish, and the active principle would probably be useful as an insecticide. This root is used as an ingredient of the arrow-poison used by the Malays. Another arrow-poison made from the Upas tree (*Antiaris toxicaria*), and used by the Sakeis, was shown in the Perak Section.

In the British Guiana Court a large number of astringent barks were exhibited, some of which are used in the Colony for medicinal purposes and as tanning materials, the bark of the black mangrove, *Rhizaphora mangle*, being one of the best for this purpose. The other kinds of bark used medicinally comprise Dacama bark, used in dysentery; "Sarababa," used as an emetic in fever; "Bocari," used as a stomachic; "Arecadako," used for snake-bite; "Arewewa," used as a purgative; "Kerecowa," used as an antidote to poisons; "Coutaballi," used in fevers; and "Mora," used in dysentery. Two barks said to be poisonous, and used for snake-bites, are named "Aramata" and "Coroo-coroo."

In the Jamaica Court the exhibits of native drugs comprise "chew-stick," the stems of *Gouania Domingensis*, which have a pleasant bitter taste, and contain a constituent similar to saponin. They are used as a substitute for tooth brushes. "Bitter dan" is the bark of *Simaruba glauca*, and probably resembles that of *Simaruba amara* in therapeutic effect. *Prunus occidentalis* is said to be used for flavouring noyeau, but according to Dr. Trimen that is not the case, the noyeau cherry of the West Indies being *Cerasus sphænocarpa*. "Majoe bitter" is the bark of *Picramnia antidesma*, and has been lately introduced into medicine in the United States under the name of "Honduras bark" or "Casca amarga." The bark of *Andira inermis* has long been known under the name of "bastard cabbage bark" as a powerful and somewhat dangerous anthelmintic. "Fitweed root," obtained from *Eryngium fœtidum*, appears to be a powerful anti-spasmodic. "Adrue," the rhizome of *Cyperus articulatus*, is said to be as efficacious as cinchona bark in the cure of remittent fever, and a decoction of it restrains the vomiting in yellow fever. It has lately been used in the United States. "Dogwood-root bark," *Piscidia erythrina*, has lately been recommended as a hypnotic in insomnia arising from mental worry, and as an anodyne in idiopathic neuralgic affections. "Balsam-tree bark" is probably the produce of *Amyris balsamifera*. "Wild worm-wood," *Parthenium Hysterophorus*, is the source of the alkaloid parthenine, said to be useful in the treatment of neuralgia. "Guinea hen weed,"

Petiveria alliacea, is extremely acrid. "Bocconia root," from *Bocconia frutescens*, a papaveraceous plant, has properties resembling those of *Chelidonium*, and is used for ringworm, warts, &c.

The medicinal drugs exhibited in the Trinidad Court comprised "Semen Contra," the produce of *Chenopodium ambrosioides*; "Liane tasso," the young branches of *Schnella excisa*, an astringent drug used in diseases of the kidneys; "Manioc chapelle," the roots of *Entada polystachya* and other species, containing saponin. "Fruita De Burro," the seed vessel of *Xylopia salicifolia*, used as an aromatic bitter stimulant; "Gully root," or "Stink weed," the root of *Cassia occidentalis*, used as a diuretic in dropsy; "Guatamare," the pod of *Myrospermum frutescens*, used as a carminative and stomachic, the tincture being also used externally to relieve pain. When the bark of this tree is incised, a balsam exudes that is said to be very similar to balsam of tolu.

In the St. Vincent Court noyeau bark and leaves (*Cerasus sphænocarpa*) and sapote seeds (*Lucuma mammosum*) were shown as the materials used for flavouring liqueurs. "Olivier bark" (*Chuncoa obovata*) is used like ipecacuhana in dysentery. "Snake wood" is used in the preparation of a native drink.

In the West African Courts a large number of native drugs were shown, and some among them would probably be worth further examination in regard to their composition and therapeutic effects; but so little is known respecting them that it would be of little use to refer to them more particularly.

The chemical products shown in the Colonial Sections of the Exhibition were comparatively few in number, and did not in any case appear to furnish an adequate representation of the extent to which chemical manufacturing operations have been developed in the several Colonies. Soap-making, which has been characterized by Liebig as affording a measure of the wealth and civilization of a country, was represented in several of the Courts, but, at the request of Mr. Leopold Field, this industry has been left for him to deal with in his report on oils, fat, &c.

In the Canadian Court chemical industries were represented chiefly by exhibits of salt, refined for dairy and table use, soap and manures of various kinds, petroleum products for burning and lubricating purposes, mineral paints, blacking, glue, varnishes, tanning and dyeing extracts, among which the extract of hemlock bark (*Tsuga canadensis*) constitutes an article of much importance for export. The manufacture of aërated water of various kinds was also well represented.

In the New South Wales Court the chemical industries represented were soap- and candle-making, the manufacture of kerosene oil from shale, animal oils, blacking, baking-powder, aërated waters, vinegar, and other articles of domestic use; but there was an absence of exhibits illustrating other important chemical industries.

In the Victoria Court the exhibits of this class were of a similar nature, comprising soaps, soda crystals, disinfectants, candles, animal fats, glue and aërated waters.

In the Courts of South Australia, Queensland, Western Australia and New Zealand the exhibits of chemical products were also of a similar description.

In the Fiji, Cape of Good Hope, and Natal Courts the chief chemical

products exhibited were the various kinds of starch known as sago, arrow-root, &c., soap and candles.

In the British Guiana Court the starches obtained from the bitter cassava and sweet potato were shown as illustrating an important local industry.

In the West Indian Courts similar starches, as well as that of the sago palm, were exhibited from Jamaica, Trinidad, Barbados, Grenada, St. Vincent, Tobago, St. Lucia, Antigua, Dominica, Montserrat and British Honduras. In the Trinidad Court citrate of lime was shown as a product from lime-juice, which would be available for convenient transport without undergoing alteration destructive of the citric acid. The other chemical products in these Courts were salt and soap.

The manufacture of salt is in several of the Colonies an important branch of chemical industry. In Ceylon it is a considerable source of revenue, and is carried on as a monopoly of the Government. The manufacture is mainly conducted by two Government establishments on the west and south coast of the island. A model of one of these works was exhibited. The salt water is drawn from an extensive lagoon, about twenty-eight miles long, and from four to eight miles broad. The water within this lagoon evaporates under the influence of the sun and wind, so that it becomes considerably denser and more concentrated than sea-water. The collection of salt usually takes place twice in the year, and the first operation is to enclose a certain area of the lagoon by means of a dam, so as to exclude the influence of the tides, while encouraging evaporation and enabling the organic impurities to settle in the still water. After a certain time the water is drawn off into shallower and smaller basins, where the evaporation is still more rapid, and subsequently into the crystallizing beds, where the salt is deposited in crusts varying from 1 to 2 inches or more in thickness, and is then drawn out. At the factory on the west coast the outturn varies from 50,000 to 500,000 cwts. in one year. The work is carried on by contractors who own the land, and under the supervision of Government officials.

In the Bahamas the salt industry was formerly one of the most important pursuits, and almost every one of the islands had its salt lake. At Inagua the salt works are stated to have cost as much as £20,000, and enormous quantities used to be made there and in the other islands for export to America, but the high duty now imposed upon this article by the American Government has crippled this industry. A fine sample of Inagua salt was exhibited in the Bahamas Court.

At the Cape of Good Hope salt is obtained from subterranean layers, and there are several places where it is worked. At one of them near Uitenhage the "salt pan" is three miles long and a mile broad, and it has been valued for rateable purposes at £18,000. The pan is a depression about 40 feet deep, where rain-water collects and dissolves the salt. The saturated solution is drawn off into evaporating pans to crystallize. Exhibits of the salt in different qualities were shown in the Cape Court.

Besides the articles mentioned above as more strictly chemical products in the ordinary sense of the term, there were many exhibits which represented chemical manufacturing operations, such as the production of wine, beer, spirits, sugar, leather, &c.; but since these classes of exhibits form the subjects of special reports, it is unnecessary here to do more than mention them thus incidentally.

The pharmaceutical products exhibited were numerous, and in many instances they gave evidence of an advanced condition of the pharmaceutic art in the several Colonies. Some of the exhibits of this class could not, however, be judged of otherwise than superficially, as in the case of liquid extracts, &c., in reference to their appearance. In the Canadian Court these preparations were conspicuously shown together with a number of patent medicines.

In the Victoria Court eucalyptus preparations in the form of ointment, &c., were shown together with liquid extracts and various forms of the astringent juice of the red gum tree (*Eucalyptus rostrata*), which is employed as a mucilaginous astringent in throat affections, and the juice of the *Eucalyptus globulus* used in fever, and as a tonic remedy.

In the Queensland Court the pharmaceutical products comprised tincture of pituri, extract of *Erythroxylon australe*, a powerful astringent, extract of *Alstonia constricta*, used as a tonic, extract of *Sideroxylon laurifolium*, used in diarrhœa, and the extract of *Euphorbia pilulifera*.

In the New Zealand Court the liquid extract of Koromiko (*Veronica arborea*) was shown as a remedy for diarrhœa and dysentery.

As closely allied to pharmaceutical preparations, some articles of perfumery may be mentioned which were exhibited in the Canadian, Victoria and New Zealand Courts. These were of very excellent quality, but in no way special products of the Colonies. As already mentioned, however, there are numerous raw materials in the Australian and West Indian Colonies that might be turned to useful account for the manufacture of perfumes. In this connection mention may be made of the numerous exhibits of essential oils that would be available for making perfumery. In Jamaica, plants yielding fragrant oils are abundant and there is a wide field for their industrial application. Many of these plants are very abundant, and obtainable in large quantities. Others, like tuberose and jasmin, might readily be cultivated. A first attempt to establish a flower farm and factory for extracting perfumes is now being made in this island. In the Bahamas, also, this industry might be carried out, for there the orange flower and many other scented blossoms are even more odoriferous than in the South of France. There appears to be already a considerable production of the essential oils in Montserrat and Dominica. In the latter island also bay rum is made by distilling the spirit with the leaves of the pimento (*Pimento acris*), which is a native of Dominica as well as Jamaica.

OILS AND FATS.

By LEOPOLD FIELD, F.R.S.E., F.C.S.

THE fact that the hundredth anniversary of M. Chevreuil's birth fell in the past year, imparts a peculiar interest to a report dealing, as this does, with those bodies to the composition and perfect utilization of which he furnished so complete a clue. It is natural, therefore, to inquire how far mankind has used the key placed at its disposal: how many doors have been thrown open, how many districts explored in the rich domain of Fats and Oils. It is equally natural to turn to the Exhibition for an answer. For never, perhaps, before have so many well-known sources of unctuous material contributed to a common display; never have such remote regions been so ransacked to furnish rare specimens. Hence this Exhibition may be looked upon as affording fair premises for an estimate of the progress made towards the full knowledge and use of raw and waste fatty bodies, in the fifty years that have elapsed since the Bougies de l'Étoile first bore witness to the value of M. Chevreuil's researches.

That the result is not so favourable as might have been hoped, is due mainly to the great cause of all stagnation, namely, overproduction. While there is a glut of the familiar, long-tried materials, Tallow, Palm and Cocoa-nut oils, with an enormous reserve of Cotton-seed oil suspended in America, how can we hope for the successful introduction of unproved rivals? One might as lief bore Artesian wells in an inundated country. Another reason is this: that manufacturers are, as a rule, quite in the dark as to the source and conditions of supply of a new product, when, as occasionally happens, it comes on the British market. Even if the initial quantity be large enough to allow of a full boil of soap, or batch of stearin being turned out, what does it profit the manufacturer, if he cannot rely on a continuous and homogeneous supply? There is no more dangerous commercial blunder than to create a demand for goods of which the future supply is uncertain. The price, also, is seldom reliable as representing the real value of the novelty. The broker has instructions to "get what he can for it;" he consults a friendly trade-expert, whose opinion is generally strongly flavoured with a disinclination to take the strange lot himself; so the parcel goes begging around the trade, till it is bought up at a nominal figure, and gradually "worked in" with recognised materials. This, of course, discourages the producers effectually from any further shipments.

Chinese wax, "Pela," and Vegetable tallow are two notable instances of the above, and will be referred to more specially in their respective places.

But, even disregarding the absence of any evidence of attempts on the part of the exhibitors to work the rarer oils, the absence of the commoner, universally manufactured bodies is very remarkable. Of stearic acid in block there was not one specimen; oleic acid was also entirely unrepresented; glycerine likewise; bleached beeswax and refined spermaceti too were absent. Though soap was fairly represented, there were but three exhibits of candles, and one of these reflected little credit on the exhibitor.

Altogether, though to the chemist curious in oils, the exhibits afforded a large range of almost new ground, the manufacturer, looking for signs of something more than the mere ability to "render" fat or crush seeds, must have felt disappointed. It must however be borne in mind, that the sources of supply and demand are generally little "en rapport": that Chevreuil's first essay at turning his discoveries to practical account was a failure, and that while a knowledge of chemistry still forms a very small factor in the sum of most manufacturers' accomplishments, chemists frequently lack the practical and commercial knowledge which alone can make their discoveries of value to trade.

In giving a detailed account of the several exhibits, it appears advisable to group them under the headings rather of the substances, than the countries, as space is lacking to take the exhibits of each Colony separately. The division proposed is that of the three kingdoms—Animal, Vegetable, and Mineral: Animal to be subdivided into land and marine; Vegetable, into nut, seed, fruit oils, and waxes; the Mineral including paraffin, petroleum, and their products.

This classification, though perhaps less welcome to the individual exhibitor, will give the general reader a better idea of the respective contributions of the Colonies to the various domains.

Land Animals.—Tallow, Lard, Neat's-foot and Trotter Oils.

Tallow and palm oil are the great staples of both soap and candle trades. In point of quantity imported into England, palm oil exceeds tallow considerably. The Board of Trade returns for 1885 show 45,000 tons of the vegetable against 20,000 tons of the animal fat. But the great difference between the import-figures of these two leading articles is readily accounted for by the large home production of tallow, upon the fluctuations of which the imports chiefly depend. The falling off in recent years both in quantity and price is most startling. In 1881, the amount of Australian tallow imported was nearly 90,000 casks (about 7 cwts. each), and the average prices 33*s.* to 44*s.* per cwt. In 1885, the number of casks imported was about 53,000, and the average prices 24*s.* 6*d.* to 33*s.* 6*d.*

Such a variation naturally exercises a portentous effect on the soap and candle trades generally, as all other raw materials and manufactured articles must follow to a greater or less extent. Though reliable statistics for 1886 are not yet obtainable, it is only too certain that prices have fallen at least another 10 to 15 per cent. The closing market quotation for tallow in 1886 was 24*s.* beef, 27*s.* mutton, and for palm oil (Lagos), 22*s.* Nor can any strong hope of an immediate revival be held out. The abundant production of paraffin scale, and the direct application of it in a semi-refined condition to the manufacture of candles, of a pretty, light yellow tint, a tolerably high melting point and a slow yet brilliant combustion, has knocked the cheap distilled stearin, so-called composite and snuffless dip candle, out of the field. Night-lights too, manufactured of pressed cocoa-nut oil, command a great and increasing sale, greatly to the detriment of the old, well-known brands, into whose composition weak stearin largely entered. As the estimated production of paraffin for next year is in advance of the normal demand, and as more and more firms have taken to

colour and ornament these cheap candles, which by reason of their transparency and pliability lend themselves so readily to such adornment, it seems as though stearin candles, in Britain at least, had had their night.

In support of this prophecy it may be mentioned that paraffin candles, at 123° m.p., and of a faint straw-tint, are being retailed at 4*d.* per lb.! a price at which it would be difficult to purchase common stearin by the ton.

The exhibitors of tallow, with one exception, were all Australian; and as might be expected, their exhibits were excellent. It is impossible to avoid the presence of free fatty acids in tallow kept for some time under ordinary conditions; and, therefore, no note was taken of this insuperable blemish.

Messrs. Walsh, Elliot and Co., Botany, New South Wales, exhibited very fine beef and mutton tallow: of a m.p. ca. 90° Fahr. for the beef, and 100° to 102° for the mutton. The latter was so white and hard as to give rise to a belief that it had been subjected to pressure; which supposition, indeed, would be further warranted by the solidifying point of the free fatty acids, 122° to 123° Fahr., which, according to Dalicant, is evidence of nearly 77 to 78 per cent. of solid (stearic and palmitic acids). Both qualities were very sweet.

The Hogarth Company, Toowoomba, Queensland, also exhibited excellent tallows, though (which may easily be accidental) the colour was slightly darker, and the free acid larger, than in the preceding samples, m.p. 90° to 91° Fahr.

The Gear Meat Preserving Company, Wellington, New Zealand, showed tallow in casks, the appearance and consistency of which was good, and smell sweet. Not sampled.

Messrs. Carwardine, of Victoria, were also not sampled. The exhibits of Messrs. Kitchen, of Victoria, and Messrs. Mofflin, of South Australia, though catalogued, were not to be discovered.

Of tallow oil and margarin, there were no samples shown.

The Falkland Island Company exhibited a tallow of exceptional quality, and a very high m.p. 93° Fahr. Some slight tests as to its lubricating powers were very satisfactory, and, to judge superficially, gave results equal to any that Russian (P. Y. C.) tallow would afford. In fact, the marked preference given to the P. Y. C. brand by the British Government, and engineers generally, must be allowed to rest rather on tradition than on actual merit. It is stated that Russian tallow possesses lubricating powers superior to other brands; but this, however true twenty years ago, would need considerable demonstration to-day. The price of P. Y. C. is generally 10*s.* per cwt. above that of Australian. This is chiefly speculative. The fact remains, however, that Government requisitions are mainly for Russian tallow. Whether Government always gets what it asks for, is another question. The analyst who could with certainty distinguish between fine Australian or Falkland tallow and the Russian brand supplied to the Government offices, would be far advanced in his profession, and likely to make his mark. Curiously enough, the only sample of genuine Russian tallow examined within the writer's experience, contained 12·2 per cent. of free acids, as against 1·2 to 4·7 per cent. contained in thirty-six samples of Australian tallow.*

* W. H. Deering, *Journ. Soc. Chem. Ind.* iii. 540; A. H. Allen's Organic Analysis, i. 139.

Lard oil, employed for exceptionally fine toilet soaps and for lubricating certain kinds of machinery, is exhibited only by Messrs. Strachan and Co. (Montreal, Quebec), whose sample is of as fine a colour and sweet a character as can be wished.

Neat's-foot and Trotter oils, employed principally for lubricating the machinery of large clocks, and dressing fine leathers, had several exhibitors.

The qualities were tolerably on a par—all being first-rate.

Here again, Messrs. Walsh, Elliot and Co., of New South Wales, were well represented by exceedingly white samples, which did not solidify on being cooled to 32° Fahr., the chief desideratum in this class of oil.

The Hogarth Meat-preserving Co., of Queensland, and The Gear Meat-preserving Company, of New Zealand, exhibited excellent specimens of these lubricants, though the tendency to solid deposit was slightly more marked than in the Canadian sample.

Emu oil, shown by the Gascoyne Commission, Western Australia, is probably of more interest to the pharmacist than the soap-maker. The smell was very fishy, with an added something peculiar to itself. The dark-yellow, limpid oil saponifies readily, but the product has an intolerably nauseous odour. As the amount produced cannot be large enough to satisfy an extensive commercial demand, it is perhaps not worth while discussing emu oil further in this place.

Marine Animals.—Fish, Balænæ and Phocæ.

This class of oils is fraught with the melancholy interest attaching to aught that is moribund. For as representative lubricants, fish and whale oils, with sperm oil at their head, have almost ceased to exist. American, Scotch, and quite lately, but by no means least of all, Russian heavy hydrocarbon oils have usurped the place of their animal predecessors in lubricating, as kerosene and petroleum have supplanted sperm and colza as illuminants. Seal and shark oils will always enjoy a certain value as adulterants of sperm oil for "bodying up" the heavy hydro-carbon lubricants, and imparting the familiar odour to them.

Neither spermaceti itself nor sperm oil were exhibited; nor any of their cetacean brethren, as doegling, bottle-nose, and the like. Next come the whale and seal oils, including the porpoise, dugong and others of a like species. It should be noted, however, that the genuine dolphin belongs to the Cetacean group, yielding oil of a finer quality, and quite distinct in composition from that of members of the Balænic. The former are really liquid spermacetis or waxes, almost, if not entirely, devoid of glycerides, and containing nearly 40 per cent. of higher alcohols; whereas the whale and seal oils contain glycerides of the higher fatty acids, notably valeric acid.

In Canada, the Snidegate Oil Company of British Columbia exhibited a very comprehensive and interesting collection of fish and quasi fish oils. It is impossible in a report of these dimensions to enter upon the individual characteristics of so large a number of comparatively unknown oils. It may be open to question, in view of the numerous sweet and wholesome products yielded by such a variety of fish, whether the cod is entitled to so unique a position as it holds in the pharmacopœia. Instance the herring oil, very white, odour hardly perceptible; the candle-fish oil, nearly as

sweet as almond oil, and quite as white; salmon oil, very clear, deep red, and considerably more palatable than cod-liver oil.

The shark oil, exhibited by this company, was peculiarly fishy and unpleasant, compared with other exhibits.

The Commissioners for New South Wales Fisheries also exhibited a series of fish and whale oils, containing specimens as fine as any that have as yet come under the writer's notice. The shark oils yielded, as is usual in genuine samples of that kind, a large amount of unsaponifiable matter, and, for the most part, were fine and sweet enough to answer their frequent purpose—viz., that of adulterating cod-liver oil. Shark oil itself was so largely adulterated as to have fallen into disuse in this country.

WESTERN AUSTRALIA, as represented by the Vasse Local Committee, did not exhibit to the extent that its extensive fisheries would lead one to expect. Only whale oil and shark oil were catalogued, and of these only whale oil was exhibited. This, in compensation as it were, was of a quality unlooked for in such an oil: indeed, the colour and smell nearly resembled similar characteristics of neat's-foot oil, from which, but for a very slight fishy bouquet, it would, to smell and sight, be undistinguishable. The specific gravity, however (929), is that of a whale oil (neat's-foot, 916); its viscosity at a low temperature also tends to distinguish it, though the saponification equivalents are nearly identical. This is an excellent example of the perfection to which careful selection and refining can bring the most unsavoury materials.

QUEENSLAND.—The Commissioners exhibited some very fine dugong oil, refined and unrefined. This substance, especially when refined, is quite water-white, odourless, and palatable, possessing little, if any, of the fishy flavour characteristic of the fats from that class of mammals. Though readily saponifiable, the quality of the soap produced is not remarkable enough to warrant any stress being laid on the production of this fat for soap-making. The amounts produced cannot be very large, and it appears that the animals grow scarcer every year. Such being the case, it would be well if the attention of pharmacists were directed to an oil so evidently superior to all its kindred as a palatable substitute for the fish-liver oils. This would tend to prevent the dugong being classed with the common seals and other phocæ, and preserve its oil for a nobler use than that of inferior soap-stock or lubricant.

In ST. VINCENT, Mr. Snagg exhibited, among other fish oils, a very fine specimen of porpoise oil, nearly white, and depositing considerable amounts of fatty acids. The soap from this yielded, on decomposition, a solid cake of fatty acid solidifying about 120° (though the temperature was not sharply defined) and quite free from fishy odour. This oil would make a good soft soap.

ST. LUCIA.—The Agricultural Society exhibited, besides some very dark and strong whale oil (*quite* liquid) and ordinary shark oil, some "Nayé" oil, a white, clear liquid, highly fishy to smell, the source of which under that name is unknown to the writer.

It would be difficult and presumptuous to speculate as to the future of

these oils, in view of the glut of animal, vegetable, and mineral substitutes, which, at low prices, replace these in almost all applications. As adulterants and sophisticants of mineral oils and of each other, they will no doubt always command a sale; but for making cheap soaps, and as illuminants, in Britain at least, under present conditions, they must gradually become extinct. For some purposes, as hardening steel for tools and arms, sperm and whale oils are still especially employed; as also for oiling the finer kinds of machinery. But even for this latter purpose, shale and petroleum oils are being largely adopted, and the most conservative of manufacturers are tempted, by the great difference in price, into giving these new lubricants a trial. Attention is now being given to the skilful blending of fish and mineral oils, apparently with great satisfaction to the consumers.

Vegetable Fats.—I. Nut, Seed, and Fruit Oils.

Palm oil must take precedence of all the host of vegetable fats, seeing that the imports of this one item into England almost equal in amount those of tallow, cocoa-nut, and all the rest together.

In 1880 there were actually 51,000 tons imported into England, the closing price being £30 a ton for Lagos. In 1885 the imports were 45,000 tons, at a closing price of £26 per ton. In 1886 the imports are not yet declared, but the closing price is actually £22, as against £40 in 1883, when the imports were 37,000 tons.

The production knows apparently no limit except that of restricted labour, and as the kernel of the palm nut contains about 50 per cent. of an oil which, when properly extracted, is nearly equal to cocoa-nut oil for soap-making, and which leaves a good nutritive oil-cake, palm oil has no waste product to hamper its manufacture.

The only recognised source of palm oil is the West African Coast, whence Lagos sends the finest brand, and that most sought after by soap-makers. Other brands are Bonny, Brass, Old and New Calabar, &c., of which the Bonny brand commands about £1 per ton less than Lagos.

A fat closely allied to palm oil is *Shea butter*, also known as Galam or Bambouk butter, the produce of several varieties of palms in the Niger districts, chiefly the *Bassia Parkii*.

This may be ranked among those mongrel fats that are only used because they are there, and have no individual qualities to incite a demand. For use in soaps and distilling with weak palm oils, Shea butter may be advantageously used when the price is low. About 500 tons are imported annually at a price fluctuating with that of palm oil and tallow.

In the West African Court it is significant and illustrative of a remarkable feature in this branch of the Exhibition, that an English company had the finest, indeed almost the only good exhibit in the Court.

Price's Patent Candle Company showed a splendid series of specimens, ten in number, starting with the crude palm oil, and including crude and finished glycerine, stearic, and oleic acids. As might have been expected, each specimen was an example of the best material that can be made, and criticism is out of place. Glycerine, which this firm has made its speciality, is otherwise unrepresented in the Exhibition. This substance has exhibited elasticity of price almost unequalled in commercial annals.

In 1881 crude glycerine was in active demand at from £75 to £80 per ton. In 1885 some thousand tons were seeking a purchaser at £18 or less a ton. When this report was commenced (July, 1886) the latter figures still held good. At present (February 1887) crude glycerine is rising rapidly in price, and now fetches £45 to £50 per ton. This naturally influences the stearin trade considerably, and if continued will tend still further to lower the price of stearin, which hitherto has been kept up as a counterpoise to the low value of its by-product. Besides its value in the soap and candle industries, palm oil finds a large application in South Wales and elsewhere for the manufacture of tin plate. The iron plates are protected from oxidation in a bath of heated palm oil, generally Lagos or Bonny, and are rapidly transferred thence to the tinning bath.

Messrs. Banner Bros., Lagos, exhibited some fine palm-kernels: also a specimen of palm oil bleached by exposure to air. This ready power of bleaching renders palm oil particularly valuable to the toilet soap-maker, who desires to avail himself of the delicate aroma and fine body of the oil, without being restricted by its strong yellow colour, which tinges the lather disagreeably. French toilet soap-makers employ bleached palm oil much more than their English brethren, and no doubt the delicacy and persistency of their scents is in some measure due to this preference.

Mr. G. L. Gaiser, Lagos, also exhibited palm oil of a fine yellow colour; and Shea butter.

There were several smaller exhibits of oleaginous nuts and kernels, but not of sufficient importance to claim space here.

The Government of Gambia exhibited a collection of fish and nut oils, which illustrated well the great variety and redundancy of unctuous matters, suitable for lighting, cleansing and cooking, that obtains on that coast. These were not sampled.

Next in importance to palm oil, among the vegetable products, comes *Cocoa-nut oil*, of which the exhibits were numerous, and mostly excellent.

Cocoa-nut oil has at the present time two chief applications: soap and night-lights. If candles are still made from this oil, the quantity is very small. The original "Composite" candles were made of a mixture of pressed cocoa-nut stearin and stearic acid; but this was soon superseded by the simple distillate of acidified palm oil. For night-lights, however, this oil is comparatively of novel application. Price's Candle Company manufacture their night-lights from the pressed oil, burning them in glasses, in lieu of the old paper cases. The light given by burning cocoa-nut oil is very white and brilliant, and the appearance of the night-lights generally is more tempting and cleanly than that of their predecessors. The main employment of cocoa-nut oil is in soap-making, of which industry it is a great prop. Of late years English consumers have been greatly prejudiced against soaps made with this oil, partly on account of the wastefulness thereof, partly also by reason of the rank and persistent odour remaining on the hands after washing. These objections apply still very forcibly to soaps of German manufacture, in which advantage is taken of the facility with which cocoa-nut oil lends itself to adulteration, to crowd in silicate and carbonate of soda, sugar, and water to an almost incredible extent. The smell is overcome with mirbane and lemongrass, while the brilliant transparent white body can be tinted most delicately. As the fatty acids of

cocoa-nut and palm-kernel oils stand low in the series, they require a proportionately greater amount of soda to saponify; their calcium and magnesium salts also are not so insoluble, hence their soaps will lather in the hardest waters without much "curd" or "suds." But the washing and cleansing properties are inferior to those of stearic and oleic soaps; and in toilet soaps the disengagement by hydrolysis of so large a proportion of alkali acts injuriously upon the skin.

Still, the English soap-makers have gone too far in the opposite direction, and eschewed this oil altogether.

Hence the dim, dull appearance and greasy lather of most high-class English toilet soaps: to which a judicious admixture of "marine" soap would impart a bright "face" and a brisk lather.

The two leading brands of cocoa-nut oil are Cochin and Ceylon. Of these, Cochin is usually the whiter and sweeter, and commands from £4 to £5 per ton more than the Ceylon variety. This does not appear to be known to the Ceylon Commissioners, though it can scarcely have escaped the notice of the exporters. The matter is one of great importance, as a reputation for inferiority once acquired is very difficult to get rid of. It may be, that only the name "Ceylon" is now applied to inferior qualities, regardless of the source. Yet it is very certain, that the oil purchased as Cochin transcends the other in all respects; and, indeed, Ceylon is not utilizable for fine soaps and night-lights, on account both of its colour and smell. The difference may be due to the nuts, or the method of expression. At any rate, the disparity should be made the subject of careful inquiry; especially in view of the fact that in 1885 the imports of Ceylon oil into this country fell off from 8200 tons in 1884 to 4000 tons, over 50 per cent. The low prices of tallow and other sebaceous bodies naturally contribute to this result, as cocoa-nut has maintained a comparatively even price for the last few years, although in 1879, £47 10*s.* was given, as against £30 in 1886, for Cochin.

Two varieties of the oil—the ordinary commercial kind, and the "King" cocoa-nut oil, were shown by various Ceylon exhibitors. The "King" variety is said to smell much less than the common sort, and hence to be very suitable for a hair-dressing, for which purpose it is much employed in the country. It was difficult, however, to distinguish between the two kinds as shown. Of the two, the common description was the whiter, while all the samples possessed the well-known aroma almost equally.

Messrs. Leechman, of Colombo, exhibited some beautifully white oil, which no one accustomed to what is sold in London as Ceylon oil, would recognise as such. They also show some Poonac or oil-cake corresponding to that from linseed. It is most palatable, and would cause many an English child who tasted it, to envy the happy Singalese cow its rations.

The Ceylon Agricultural Association exhibited a barrel of fairly representative Ceylon oil, Poonac, and Copra. The latter article has lately been the subject of much speculation in Marseilles, giving rise to a fictitious demand and a great increase in the supply. The imports to that port during 1883 were 18,000; in 1884, 29,000; and in 1885, 40,000 tons. Now that the markets have given way there, the London markets are flooded, and the prospects of trade for some time are but poor. Of the other exhibits it may be briefly remarked as before that they are better than one would be led to expect.

Next to Ceylon the Fiji Islands perhaps were the largest exhibitors of cocoa-nuts and copra. The oil itself forms a small item of the exports from Fiji, chiefly going out in the form of copra, to the value of nearly £60,000 annually.

Messrs. Morgan and Co. exhibited a very fair specimen of oil, but they were the only firm who did so. On copra it is difficult to pass any opinion without a trial in bulk. The samples, however, in the Fiji Court looked cleaner and less mouldy than some others in the Exhibition.

Mauritius oil is now being regularly quoted on the markets at about 10*s.* per ton under the price of the Ceylon brand. From the exhibit it would be impossible to form any judgment as to the merit of the oil in bulk. A splendid sample of soap, red and blue mottled, may be mentioned here, made entirely from Mauritius cocoa-nut oil, yet presenting an appearance closely resembling the well-known Castile soap. The five months' exposure in the Exhibition had caused neither great block or small bars to shrink perceptibly. This soap reflected great credit on both maker and material. Unfortunately, by some accident, the samples did not come to hand, hence no analysis can be given.

BRITISH GUIANA, represented by Messrs. Pontifex and others, and the Fortitude Fibre Works, produces some very good and remarkably white cocoa-nut oil, although the specimens were slightly rancid and strong smelling. But these are mere accidents of circumstance. Guiana has not yet made a name for herself as an oil-producing Colony; but there appears no reason why she should not vie with her sisters in this respect. It may be a moot point, as before remarked, whether the nut itself and the method of cultivation has not as much or more to do with the colour and odour of the oil than the process of extraction. That this is so in palm oils is indubitable, but it remains to be shown of cocoa-nuts. We have a remarkable instance in Mitcham lavender of the difference *soil* will make in the quality of oil. All South France cannot produce oil commanding one-sixth of the price obtained by the owners of the little spot of Surrey soil. The same with peppermint and rosemary. The question then whether a different nut or soil is required, might be worth attention.

The STRAITS SETTLEMENTS, although including the Cocos Islands, exhibited only a few desultory specimens of copra and cocoa-nut oil on which an opinion can hardly be given. The oil does not appear in the English market under a distinctive name.

In the WEST INDIES, Trinidad exhibited several very good specimens of oil, as might be expected from an island which exports over 10,000,000 nuts annually. The oil was quite up to the average quality, and in two specimens perfectly sweet. Exhibitors, Mrs. Pollard and Messrs. Legge and Urich.

ST. VINCENT.—Mrs. Melville exhibited cocoa-nut oil.

TOBAGO.—Nine exhibitors of the same.

ST. LUCIA.—Two exhibitors.

BRITISH HONDURAS. — Four quarts of cocoa-nut oil by various exhibitors.

These exhibits were fair average specimens, but did not differ from each other sufficiently to call for special comment.

Cahoon or Cohune-nut oil and Grugru oil are two bodies much resembling cocoa-nut oil. The former has received attention at the hands of one or two chemists, but of the Grugru oil no mention can be found.

Cahoon oil, from the nut of the Cohune palm (*Attalea cohune*), is a magnificently white, hard fat, of a sp. gr. 875 at 212° Fahr. It solidifies at 72° Fahr. It saponifies with greater difficulty than cocoa-nut oil, and the action is more sudden and brisk. The product resembles ordinary marine soap, but the lather is stiffer and more permanent. The amount of caustic required is apparently less, although, as the sample examined was but small, and all consumed in one operation, figures cannot be given. This, however, may be stated, that the soap from 1 lb. of cahoon oil was distinctly caustic, though the amount and gravity of the soda lye employed would have given a neutral cocoa-nut oil soap. Cahoon soap absorbs water and mineral matters very readily, like its kinsman. A very fine transparent soap was made from the above, with the addition of castor oil from Trinidad (unrefined), glycerine, and alcohol. This soap took up 40 per cent. of a filling of carbonates of soda and potash, sugar, and common salt, and looked beautiful when tinted with rose and scented with lemon-grass and bergamot. In the minor detail of washing, this compound did not prove equal to its appearance; but one cannot have everything.

The advantage of cahoon over cocoa-nut oil is the entire absence of smell, even when heated strongly. After vigorous and repeated washing with the pure soap, no odour lingered on the hands.

Could cahoon oil be manufactured in large quantities at a reasonable price, it would no doubt take the place of Cochin oil, at any rate in the finer soaps. It is said that the rate of combustion of the two oils is as 1 : 2, *i.e.* one pint of cahoon will burn as long as one quart of cocoa-nut oil.* This disparity is sor emarkable as to call for some decisive proof; the slight difference in gravity and considerable similarity of composition not leading one to suspect it. From information given in the treatise on British Honduras, it appears that the nut itself offers the chief, almost the sole, obstacle to commercial success; the shell being marvellously obdurate, and the kernel very small in comparison. These practical difficulties can be best appreciated by those who have had similar commercial problems to solve, or rather nuts to crack. The *candle nut* (*Aleurites triloba*) affords another example of this puzzle. Doubtless the introduction of suitable machinery and organised labour will shortly prevail, and this beautiful oil will take its merited place in our markets.

The sample of cahoon oil was shown by several anonymous exhibitors in British Honduras. The solidifying point is stated to be 70° Fahr., but the sample drawn was quite solid at 72° Fahr.

Grugru oil was shown by Mr. Walker, of St. Vincent, and six gentlemen of Tobago. It much resembles a weak cocoa-nut oil, saponifying with difficulty, and absorbing much water. The soap is very white and lathers freely, and smells very faintly of cocoa-nut. Information concerning the sources and supply is wanting.

* Handbook of British Honduras. D. Morris, M.A.

Candle-nut oil (*Aleurites triloba*), also called kekuné oil, was exhibited, as to the nuts, in Fiji. The oil was shown by Ceylon (Agricultural Association and Botanic Gardens), and also by the Queensland Commissioners, Brisbane. The nut contains an astonishing amount of oil. From the samples supplied by the Fiji Commission, 55 per cent. of a fine yellow oil was extracted by carbon disulphide, which amount, large as it is, is below that given in Ure, who states the oil as forming 62 per cent. of the nut.

It appears that a difficulty obtains here similar to that in the case of the cahoon nut. The husk of the *Aleurites triloba* sits so close, and is so hard, as to defy ordinary machinery. At present, the nuts are cracked singly by the natives, and the oil extracted from the kernels in an ordinary mill. This oil is exceedingly limpid and sweet; forms a fine, waxy-looking soap (cold process), and does not solidify at 32° Fahr. It is stated to be largely exported to Europe for soap-making, and to be well adapted for cloth-dressing; but the writer has had no experience of a commercial trial having been made in England.

Castor oil.—This fat, so intimately associated with the pharmacopœia, nevertheless claims attention here as a lubricant and soap material. For heavy machinery, castor oil has long been used, especially for the engines of river boats. Those who have travelled down the Rhine will have found their enjoyment tempered by the subtle aroma of this delicate aperient that steals from the engine-house. No doubt shale and petroleum oils will shortly oust the vegetable from this function, for which its remarkably high gravity (970 at 65° Fahr.) and low solidifying point (0° Fahr.) render it peculiarly suitable.

The peculiar and unique property of castor oil, viz., its perfect solubility in alcohol at ordinary temperatures, have caused the finer qualities to be largely used in hair-dressing as "Brilliantine," which consists of an alcoholic solution of this oil. Though such a mixture is in every way desirable, as stimulating and invigorating the hair, the ineffable odour which will climb over and survive the most cunning perfumes, has brought this elegant preparation into discredit.

It might be here mentioned that a bottle, labelled palm oil, from *Elais guiniensis*, grown in the Royal Botanic Gardens Ceylon, submitted to test, proved to be genuine castor oil. Doubtless some change of labels had produced the error. The singular part of the affair was, that considerable hesitation was felt in pronouncing the oil to be that of *Ricinus communis*, inasmuch as, though fulfilling all other conditions, the oil was entirely free from taste and odour. Even on heating, the old familiar aroma did not become apparent; and, though highly averse and sensitive to the ordinary oil, the writer took repeated sips without nausea. The gravity, solubility, and saponification were those of ordinary castor oil. If this is a special variety, the matter is one of considerable interest, as the value of castor oil is inversely proportionate to its odour, both in medicine and soap-making.

For the latter purpose, castor oil has a special value. The opaque soap manufactured from it is often used in finer toilet soaps, being white and of an alabaster appearance. But it is in cheap transparent soaps that castor oil plays a prominent, even essential part. A soap made of equal parts of cocoa-nut and castor oils, saponified in the cold, without spirit, needs only a little glycerine and sugar to become quite transparent. The great

demand for cheap transparent soaps that has arisen within the last ten years, could not have been satisfied by English makers without their use of castor oil, as, in its absence, the requisite transparency has to be produced by spirit.

Such soap, however, cannot be recommended. In the first place, to effect an absolute saponification, an excess of caustic soda is required; and secondly, the smell of castor oil becomes apparent in a few weeks. But for natives, the brilliant tint and lustre, and decided scouring properties of these soaps would possess great attractions; and it is matter of surprise, that, with cocoa-nuts and castor-oil seeds to be had almost for the picking, these soaps have not been made in large quantities. This remark especially applies to Ceylon and the West Indies, where spirit is more accessible to the manufacturer than in England, where sugar is plenteous, and where, above all, essential oils abound. Alkali and glycerine are requisite, but these are nowhere scarce. The idea might be worked out with success.

The samples of castor oil shown were exceedingly numerous, both in seed and extract. In England the Italian castor oil has preference over the East Indian as being of better colour and smell; doubtless due to the superior refinement of the former.

Nearly all the West Indian Islands exhibited castor oil, refined and unrefined. Of the latter, Mr. Ardilla, of Trinidad, exhibited a fine specimen of full gravity, and odour less rank than usual in crude oil.

In British Guiana, Mr. Fresson also exhibited a very good sample of oil. *Ben*, or more properly *Behen oil* was exhibited by the Botanical Department, Jamaica. This exquisite oil, which nature would appear to have devised expressly for the perfumer, seems to be singularly neglected. At least, the writer's efforts to obtain a genuine sample have hitherto proved unsuccessful. Mr. Septimus Piesse, in his excellent little work published in 1862,* grows quite enthusiastic over this oil; as embodying the highest desiderata of the craft: freedom from all odour, tendency to grow rancid, or to solidify.

These assertions are borne out by all who write upon this subject. The sample submitted was exposed in thin layers to warm air currents for a week, without exhibiting the faintest tendency to grow rancid. Hence the oil of Behen would be (perhaps is) invaluable to the "enfleurageur" who has perpetually to combat the tendency to rancidity in even the finest lards.

It is stated that "Macassar oil" is made on a Behen basis. This being the case, it is singular that the material should never appear on the market or be offered for sale. After repeated application to Grasse, Cannes, a sample was reported as shipped. This however, to the intense chagrin of the recipient, proved to be Benné or Sesame oil, also a beautiful product, but not equal to Behen.

Jamaica, through Mr. Scharschmidt, proved her capability of doing great things in enfleurage, some very fine (although slightly rancid) jasmin and tuberose pomades being shown. Hence it may be hoped that the *Moringa pterygosperma*, or better still, *aptera*, will receive the cultivation it deserves, in a country where the oil can be utilized to the fullest extent. The amount of flower-pomades and oils consumed in England alone is enormous, and the whole supply is drawn from France. There is no duty on these goods. Why should our own Colonies not supply us? Why should all our

* Art of Perfumery. London: Longman Green & Co., 1862.

citron, bergamot and orange oils come from Messina and Spain, when the West Indies can grow these fruits in any quantity? These questions are such as arise in the mind of one deeply and patriotically interested in perfumery, without special knowledge of the particular conditions obtaining in the localities addressed.

CEYLON exhibited a variety of oils, some of which are utterly strange and unknown. In view of the present repletion of the market with the standard fats, it is not possible to stimulate with confidence the production of new substances, none of which appear to possess properties at all superior, or even equal to their well-known and time-honoured kindred.

Taking these oils categorically, we have *Margosa* or *Kohomba oil* from *Melia Azardirachta* (sp. gr. 912 at 80° Fahr.). A deep greenish-yellow oil, of a highly offensive odour, and intensely bitter taste. It saponifies readily, making a yellowish, fairly lathering soap; but possessing the odour of its parent oil in an intensified degree. The fatty acids, on being washed with dilute sulphuric acid, lose this smell in a great measure. This oil is probably of more interest to pharmacy than chandlery.

Cashew or Caju nut oil (*Anacardium occidentale*) is described in the Ceylon Court Handbook as of a pale straw colour, sweet and bland. The specimen examined was of an intensely deep green, almost black, quite opaque, and smelt objectionably. The soap formed was black. Fatty acids, dull gray-green, and softish. It is difficult to assign a use to this sample, still more so to reconcile it with the description given.

The Cashew gum, exhibited by Mr. W. Dupigny and Dr. Alford Nicholls, both of Dominica, West Indies, has nothing in common with the above; being an exudation similar to gum arabic; whereas the oil is expressed from the seeds.

Mustard oil (Ceylon Agricultural Association), sp. gr. 918, produces a beautiful soap, nearly white, and quite equal to that from sunflower seed oil. This would certainly repay cultivation, as its illuminating powers are equal to those of colza, and, apparently, no agricultural impediments exist.

Mi, Bassia, Illipe oil (sp. gr. about 940 at 70° Fahr.). From the *Bassia latifolia* and *longifolia*. The specimen examined was nearly white, with a greenish cast, and a straw-yellow when melted. This oil has lately, under various names, been much used among soap-makers. It yields a capital soap, although with some difficulty. The fatty acids are also hard and white. In a deficiency of palm and tallow, this oil would prove an excellent substitute.

Preannai oil (sp. gr. 920 at 70° Fahr.). A deep green, semi-solid oil, much resembling certain descriptions of olive oil, but turning intensely yellow when saponified. The fatty acids "seed" on cooling slowly, and yield a distinct solid and liquid on pressing. The products, however, are not sufficiently characteristic to warrant much emphasis being laid upon this oil.

Palai oil of a brownish tinge, semi-solid (small sample), proved most refractory, and nothing of any value can be reported about it.

The above oils are peculiar to Ceylon. The same Court also exhibited a very important and well-known tributary to the soap pan, namely, *Gingelly, Teel, Til, Sesamé or Benné oil* from the *Sesamum indicum*. The sample exhibited by the Ceylon Agricultural Association was of a fine straw colour,

but possessing rather a stronger smell of hemp than is desirable in first-rate specimens. Exposure to the air will always produce this odour. In England, gingelly oil is but little used. The greatest amount goes to the coppers of Marseilles, the "white olive" soap of which district is composed of this, with liberal admixture of ground nut and cocoa-nut oils.

This seed appears to thrive in any genial region. "Open, sesame" is a household word, though but a small percentage of those who employ it, know that sesame is a little brown seed. As there is already a steady demand for the oil, there is no need here to insist on the necessity of supply.

Ground-nut oil, from *Arachis hypogæa* (sp. gr. 917). — This oil is equally, if not better, known to commerce than the preceding, and is similarly used. The best sample submitted was that from Natal (G. Seymour, Snaresbrook). A beautiful soap was yielded by this example; in fact, these last two oils, and the following, appear to present the soap-maker with all he can wish for: solidity, whiteness, and brisk lather. Ground-nut oil, it is true, has a slight but highly characteristic and permanent odour. This is nevertheless by no means objectionable; indeed, the "fresh" smell of Castille soap is mainly due to the large proportion of this oil present therein.

Though indigenous to America, the *Arachis hypogæa* appears to flourish in any warm climate.

Sunflower-seed oil (*Helianthus annuus*), exhibited also in the Natal Court, is, perhaps, the finest material known to the soap-maker. Considering that the flower is a mere weed, growing anywhere, it is simply marvellous that the oil should be so uncommon. From the pound sample at disposal, by the mere admixture of lye of 38° B. in the cold, a magnificent, white, odourless soap was produced, giving a free yet permanent lather; in fact, equal to some of the most elaborately prepared toilet compounds. Sunflower soaps have long been sold, coloured yellow, and scented with cassia, but the "lucus a non lucendo" principle dominates the soap-maker as much as any one else, and from the composition of most soaps under that designation, sunflower oil is rigidly excluded. It is strange how the public persist in following the lead of manufacturers, and how these latter, in England especially, refuse to depart from old traditions. A curd soap is now what it was fifty years ago: hard, insoluble, alkaline. Yet the public ask for it, and the trade make it inflexibly the same (always allowing for increased facilities of adulteration). The perfect soap has yet to be made, and it will probably be made from sunflower oil.

Olive oil.—In the present era of adulteration, when most of the olive oil known to English consumers is a mixture of ground-nut and cotton-seed, with, often, a goodly percentage of white paraffin oils, a genuine sample from the fruit is very welcome. Australia showed some magnificent oils; but all the exhibits were so highly refined, and the price so heavy, as to exclude them from the manufacturers' schedule (*2s.* per lb. quoted). Mrs. Onslow, Menangle, New South Wales; the Vicar-General Gibney, Western Australia; and especially Sir Samuel Davenport, Adelaide, South Australia, exhibited oil equal to the finest Lucca brands; Sir S. Davenport's exhibit was as magnificent in its way, though not so comprehensive, as Price's Candle Company's in the West African Court.

It is evident that the olive can be cultivated readily and remuneratively in most parts of Australia, and as only the finest (*i.e.* the first) pressings are

used for culinary purposes, the residue and the kernels yielding an excellent soap-oil of great body, the industry is worthy of attention.

Cyprus also exhibited some excellent, though unrefined, olive oil, and doubtless will prove, in time to come, a formidable competitor of the Italians in a line now almost monopolized by them.

Vegetable tallow (Meinyah Tunkawang). — This name is applied generally to a number of fats which, as before remarked, spasmodically pervade the English markets. The tribe of fat-yielding trees is very large and widely dispersed, and no doubt, could one certain species be fixed, and its product well identified and put to thorough practical tests, it would tend greatly to clear up the existing haziness as to these tallows.

Lant Carpenter,* who has treated this subject pretty exhaustively, as one having considerable practical experience in the matter of soap-materials, states that the two distinct vegetable tallows coming from Asia are: (1) Chinese tallow, from the *Stillingia schifera*, a white, brittle fat, chiefly produced in the Chusan Archipelago; and (2) Vegetable tallow, from a species of *Hopea*, also *Tetranthea laurifolia* (growing in the Malay Archipelago). The latter appears to be identical with the samples exhibited in bamboo cases as collected by the natives. It is greenish-gray when crude, but after boiling with dilute acid a few times, becomes nearly white. No experiments were undertaken with the actual exhibit, the samples being too small—but previous experience of the writer and others show that this fat is a glycerine of a high solidifying point (85° to 90° Fahr.), yielding hard and white fatty acids, and a good soap. In a dearth of palm oil, or even as a white substitute, vegetable tallow should have a ready sale. The supply is said to be all-sufficing, but the natives are too lazy to collect and treat the nuts or berries.

Regret may be here expressed that the Hongkong Court did not exhibit either Chinese wax or tallow. Considerable hopes had been entertained that this would prove an opportunity of negotiating a commercial quantity of this beautiful material, the annual production of which is valued at £600,000. Hardly a hundredweight finds its way to England now: perhaps because, in the golden days of spermaceti, Pela was coldly received. Its highly crystalline structure and intense hardness (180° Fahr. m.p.) present some obstacles, but of a noble kind, and doubtless surmountable. Spermaceti appears to have had its day; every year now witnesses an increasing scarcity, and elevation of price (now 2*s.* per lb.). An efficient substitute would be highly welcome. The Chinese formerly used all their supply themselves for "lobchocks," &c.; but as many tons of cheap scarlet paraffin candles are imported for the same purpose, it may be supposed that a corresponding amount of Chung-pela is to be had.

Carapa, or Crab oil, exhibited in British Guiana by Messrs. Fesson, Rodway, and Brown, and in the West Indies by Messrs. Kerwood and Wilson, Tobago, would be a fine and valuable oil, but for its sickly and persistent odour. To a nose receiving this odour on its own merits, there is nothing very objectionable in it at first, although it soon grows nauseous. But the dwellers in the land of its production associate the aroma of crab oil with that of the coloured classes, who anoint themselves liberally with this ungent, chiefly it appears, as an insectifuge on the head. Such an association it is as impossible to efface, as to deodorize the oil. After

* "Soap and Candles," E. & F. N. Spon, London, 1885.

blowing hot air through a pint for twenty-four hours, although the whole laboratory reeked, the oil smelt as strong as at starting. After being easily saponified, a fine, softish cake of fatty acid was obtained, in which the smell was almost identical with that of fresh cider. The soap made from another sample (both British Guiana and West Indian samples were precisely similar), was dark brown, and of an offensive musty smell, lathering with difficulty. The oil has an intensely bitter taste, probably due to quinic acid present in the bark, and also to a bitter principle to which the name carapin is given. By dexterous perfuming it might be possible to make an acceptable pomade from crab oil, for which purpose its consistency would well adapt it.

Waxes.

Beeswax.—Beeswax, *per se*, contains little to interest, for, however carefully or carelessly collected, the ultimate result is pretty much the same. Australian beeswax is well known to English manufacturers for the heterogeneous assortment of colours in the cases in which it arrives. From almost pure white to the darkest brown all shades are present. But a little boiling with acidified water, and a few days in the sun, reduces all shades to that of pure wax, a faint yellow.

The exhibitors of wax are too numerous to individualize here, and the samples shown approach one another closely in point of merit. Looking at the innumerable sources of this leading candle material and its constant demand, it is matter for surprise that the supply is not much greater, so that the price of wax candles might be less exclusive. The name "wax" has gone far to aid the sale of the cheap paraffin candles referred to above, for everybody has a traditional reverence for the name. The candles have also several distinctive virtues: hardness, sweet savour, smokelessness, and durability. For burning in carriage lamps they are unequalled; but the price is an impossible one to most who prefer paying a sixth thereof for a pound of paraffin "wax" lights. Many would be glad to burn the pure bee-gift, were the price in any reasonable proportion to that of other qualities. The church, too, would doubtless adhere to its old traditions more rigidly, and refrain from burning "vegetable" waxes, were such piety more reconcilable with economy. The honest Germans, acting on the theory that "wax is wax," construct the majority of their church candles, to judge from a recently analyzed sample, of equal parts of stearin and ceresin, with a dash of carnauba wax "to put a good face on it."

In British North Borneo the supply of wax seems simply dependent on the industry of the population, as the wild bees build in some parts at the rate of fifty nests to a tree. In this case, there is only the labour (and perhaps danger) of collecting to be considered. In other cases, of course, the problem of disposing successfully of the honey has to be confronted, before the wax can be looked upon as profitable. The British Bee-keepers' Association are making strenuous efforts to force honey into popular favour, but apparently with, at present, limited success. It is a diet that soon cloys.

Myrtle wax.—This elegant body, which, like Japan wax, is rather a fat than a true wax, as containing glycerine, is yielded by several species of *Myrica* (*Cerifera*, *Serrata*, *Quercifolia*, &c.). The reputed source of this

product is said to be North America, but in this instance the exhibitors were Messrs. Hall and Zinn, of the Cape of Good Hope. Myrtle wax itself is too well known in the trade to need particular description, but this exhibit, amplified by the Nucleus Soap and Candle Works, was particularly interesting, inasmuch as it shows the application of this substance to honest manufacturing purposes, instead of adulteration, its usual object in Europe. Samples of the wax are shown naturally and artificially bleached and made into candles. These, though smelling strongly of tallow and burning smokily, are very sturdy and do not gutter, and must be a great boon to the neighbouring farmers. The soap, made presumably for the same customers, is highly interesting as a specimen of pure home-work; the lyes are obtained from the ashes of the Ganna Bush, known as Boer-ashes. The product, owing to the stubborn nature of the wax, is not of a high quality: indeed, it refused obstinately to lather, which, to some minds, in a soap, might appear a blemish. But the excess of alkali, which is considerable, imparts cleansing powers to the compound, which is entirely unique in character.

The exhibit, though slightly way-worn, was very complete, and reflects great credit on the gentlemen who contributed to it.

The subject of soaps generally may be here touched upon, though space will not allow of more than a superficial comment.

Soaps.

Canada mustered a considerable number of exhibitors, whose goods were, on the whole, of excellent quality. The custom, gradually gaining ground in England, of purveying laundry and household soaps in pound bars, stamped and wrapped, is a favourite in Canada, 90 per cent. of the soaps exhibited being so treated. The great majority of the household soaps were what is known as "Primrose" soaps, containing from 10 per cent. to 25 per cent. of resin, and generally from 55 per cent. to 65 per cent. of fatty acids.

Messrs. Barsalou, of Montreal, Quebec, perhaps took the lead in household soaps, for the elegance of the turn-out and genuine nature of the soap. Their "Domestic Bar" curd, though too alkaline, was as fine a soap of its kind as could be desired, containing 71 per cent. of fat.

To go to the other extreme, Messrs. Pendray, of Victoria, British Columbia, exhibited some mottled soap made from cocoa-nut oil, highly alkaline, and wasting rapidly in water. The colours employed in mottling were of startling brilliancy, vivid red and blue. Evidently this soap is purveyed for the lower classes, but the price could not be ascertained.

Messrs. Watts, of Brantford, also made a capital show, their "Ivory Bar" and Electric brands deserving especial notice.

In *Toilet Soaps*, the Morse Company (Toronto, Ontario) had the chief, indeed, with exception of the Anchor Company, the only Canadian exhibit of this class. Their toilet soaps were hard and well dried, but not so free in lather as could be wished. They were pearlashed, on a boiled resin soap basis, but contained too much free alkali. None of the samples showed any trace of "throwing out" due to excessive pearlash and imperfect drying. The perfume leaves much to be desired, being hardly perceptible. Pro-

bably a heavy duty hampers this class of trade considerably. American soaps are, as a rule, got up regardless of cost, and fetch an exceedingly high price, ¼ dollar being frequently paid for a tablet. The cheapest soap that the writer saw in New York was a transparent cake, weighing about ½ lb., smelling strongly of castor oil. This retailed at 3*d.*; while in London exactly the same tablet was fetching 1½*d.* In the writer's experience, England is the only country where a delicately perfumed, moderately neutral, prettily tinted toilet soap can be bought at the rate of 6*d.* per pound, without paying for silica, clay, farina, &c. Old Brown Windsor still sustains its reputation as the leading soap in this category, and its large sale has stimulated the Continental makers to raptures of imitative and adulterative art.

In NEW ZEALAND, Messrs. Hjorth & Co. showed the best toilet soap, by far, in the Exhibition. Most of the varieties were milled, and in quality nearly, if not quite, equal to French manufacture. This firm exhibited a Brown Windsor, but it was milled, which was not characteristic of a genuine "Windsor." If exception might be taken in such general excellence, it would be to the tendency to excess in cocoa-nut oil, which, notably in the Brown Windsor referred to, was distinctly discernible. This renders the lather weak, and disengages too much alkali to be beneficial to the skin.

Messrs. Hjorth & Co. also exhibited a very fair transparent soap, made with spirit on the cold-process system. This soap is very neutral, and lathers freely.

In VICTORIA, Messrs. Lewis Whitty showed some neat bars of borax and carbolic soap, made on a curd basis. These were prettily coloured, and washed tolerably well, although the lather, as might be expected, was not very ready. The quantities of borax and carbolic acid were very small.

Messrs. Dickson and Son, and Piper and Co., of NEW SOUTH WALES, and Messrs. Handcock and Ruddell, of QUEENSLAND, exhibited household soap, rather heavily resined, but firm and tolerably neutral—probably cheap.

CYPRUS showed a few bars of mottled olive-oil soap—presumably mixed with ground-nut oil. This was very like the well-known Castile soap: very neutral and hard, yet readily soluble. If made in quantities, this soap would have a ready sale.

In the STRAITS SETTLEMENTS some very curious soap was displayed. The finer quality was white, and covered with fine crystalline efflorescence. The coarser was dusky red, very gritty, and also coated with alkali. These soaps were evidently composed of cocoa-nut oil, saponified directly with the carbonated alkali derived from wood ashes. As a specimen of original soap, possibly typical of the "sope" of the Old Testament, this exhibit was very interesting.

In TRINIDAD, Messrs. Hales and Jewell and Mr. Machado exhibited soaps both household and toilet, the quality of which was but poor.

The domestic brands were composed of weak fats and much resin, of a dark colour, and alkaline; and the bars had shrunk so much as to indicate a large excess of water in the original composition. The toilet tablets were loaded with mineral pigments, caustic, and redundant in cocoa-nut oil.

The subjoined analyses may be of some interest, as giving the comparative compositions of Colonial and leading English soaps* :—

HOUSEHOLD SOAPS.

	Ivory Bar.	Cold Water.	Telephone.	Klensodor Electric.
Fatty anhydrides + resin	68·33	69·85	62·70	50·70
Combined alkali (reckoned as Na_2O)	7·72	8·00	7·92	6·88
Excess of alkali (reckoned as Na_2CO_3)	2·64	2·22	3·91	5·05
Water, salts, &c.	21·31	19·93	25·47	37·37
	100·00	100·00	100·00	100·00
Resin by Gladding's process	25·0	24·0	—	—
Free alkali (calculated as Na_2O)	1·54	1·30	2·29	2·95
Caustic alkali	—	—	—	—
Molecular weight of fatty acids	283	280	254	238

	Cook's "Primrose."	Paton and Charles' Cold Water.	Cook's Bleached Palm.	Good kind of Imitation Castile.
Fatty anhydrides + resin	62·28	65·70	66·18	61·45
Combined Na_2O	7·12	9·28	7·83	8·46
Free alkali (Na_2CO_3)	·14	·58	·68	3·18
Water, salts, &c.	30·46	24·44	25·31	26·91
	100·00	100·00	100·00	100·00
Resin by Gladding's process	15·4	—	—	—
Free alkali (Na_2O)	·01	·34	·40	1·16
Caustic alkali	—	—	—	—
Molecular weight of fatty acids	280	230	270	234

FINE SOAPS.

	Barsalou. Mottled.	Barsalou. White.	Bouquet.	Violeta.	Borax.
Fatty anhydrides, &c.	70·15	71·65	72·39	62·39	Only traces of borax present, too small for quantitative determinations.
Combined alkali (Na_2O)	9·53	8·55	8·82	8·96	
Free alkali (Na_2Co_3)	0·87	2·82	1·76	2·02	
Water, salts, &c.	19·45	16·98	17·03	26·93	
	100·00	100·00	100·00	100·00	

	Barsalou. Mottled.	Barsalou. White.	Bouquet.	Violeta.
Free alkali (calculated as Na_2O)	·51	1·65	1·03	1·18
Caustic alkali	—	—	—	—
Molecular weight of fatty acids.	237	261 Too alkaline.	263 Too alkaline.	223 Bad soap, very alkaline: much cocoa-nut oil.

* I am much indebted to Dr. Alder-Wright, F.R.S., for his valuable assistance in these analyses; also to Messrs. F. J. Eaton and Son, Liverpool, and Messrs. Gurne, Bowes & Co., and Rose, Wilson & Co., London, for the statistics of oils, &c.

	Boehm's "Rose."	Wright's Coal-tar.
Fattty anhydrides	76·60	72·10
Combined Na_2O	9·21	9·73
Free alkali (Na_2CO_3) . . .	·13	·34
Water, salts, &c.	14·06	17·83
	100·00	100·00
Free alkali (calculated as Na_2O) .	·07	·14
Caustic alkali = ...	—	—
Molecular weight of fatty acids .	267	239

Mineral Oils, Paraffin Wax and Candles.

In Canada, the Alpha Oil Company (not catalogued) had a beautiful and comprehensive exhibit of petroleum oils for all purposes. These will, it is stated, replace cotton and olive oils in so delicate a task as wool and cloth dressing, and the oils are undoubtedly as fine, both in colour and substance, as any to be seen. The process of manufacture is, at present, secret. The specimens exhibited were so small that no samples could be taken for testing.

Messrs. Waterman, of Ontario, also exhibited a great number of oils from petroleum, which, though not of such surpassing quality as the preceding, were very excellent, and also applicable to almost every conceivable purpose. This firm also exhibited some fine white paraffin, m.p. 126, and numerous articles made therefrom, candles among the number. These burnt fairly well, and were white and transparent, but the colouring was not first-rate. The tints are heavy and the pigments employed detrimental to the burning power of the candle, the wick being clogged. The price was not ascertained; but candles of better appearance and burning at least equally well are being sold in England at a very moderate price. As a proof, nevertheless, of what can be done with petroleum, this exhibit deserves high praise.

With regard to the Australian Mineral Oils and Wax, Mr. Handcock, of Ipswich, Queensland, exhibited some very creditable candles, burning well, white and transparent.

In Victoria, the absence of the Apollo Company, the best known and most formidable rivals of their English brethren, was equally conspicuous and regretable.

The finest candles exhibited were those of The Australian Oil and Mineral Company, Sydney, New South Wales. Besides some excellent kerosene oil, this firm showed brilliantly white candles of 132° Fahr. m.p., equal for appearance and burning to any of their genus in the British market. It was not stated at what price these goods are sold, but if at a low figure, English rivals have but a slender chance of competition.

In New Zealand, Messrs. Kitchen and Sons had an exhibit of what were once good candles, both of paraffin and stearin; but these were so old and time worn, and had evidently done duty so long, that the voice of criticism is hushed in the respect due to extreme age.

A Carib flambeau and a West African candle formed of oily nuts strung on a twig, which gradually burn away, were among the curiosities of the Exhibition, as testifying to the shape of the primeval candle.

The following statistics are excerpted from reports kindly furnished by leading London and Liverpool houses, and may be of interest as corroborating some of the foregoing statements. It should be noted that the figures and remarks refer, where not otherwise stated, to the year 1885.

Tallow.—This market steadily fell throughout the year 1885, caused mostly by the over-production in England and on the Continent. The imports of Australian tallow were not excessive, being about 20,000 tons, against 23,900 in 1884; but, owing to accumulated stocks and slackness of trade, found a difficult sale, and prices realised must have shown considerable losses to importers. As compared with this time twelve months, the shrinkage in value is fully 25 per cent. Russian was again in diminishing supply, but still maintains a high proportionate value on account of its special lubricating properties.

	Jan.	Feb.	Mar.	April.	May.	June.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Fine Mutton . .	34 3	34 0	33 6	33 6	33 0	30 6
Fine Beef . . .	33 3	33 0	32 0	31 0	29 9	28 0

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Fine Mutton . .	30 6	29 0	29 0	27 9	25 6	26 0
Fine Beef . . .	28 0	26 6	27 6	27 3	24 6	25 9

Year.	Import. Casks.*	Mutton Prices.	Beef Prices.
		s. d. @ *s. d.*	*s. d.* @ *s. d.*
1876 . .	66,573 . .	41 0 @ 51 0 . .	39 6 @ 48 0
1877 . .	69,033 . .	39 0 „ 45 0 . .	38 0 „ 43 0
1878 . .	47,437 . .	36 0 „ 42 0 . .	35 0 „ 39 9
1879 . .	68,252 . .	31 0 „ 44 0 . .	30 0 „ 41 3
1880 . .	87,152 . .	33 0 „ 40 0 . .	32 0 „ 40 9
1881 . .	88,434 . .	34 6 „ 45 3 . .	32 6 „ 43 0
1882 . .	69,434 . .	40 0 „ 48 0 . .	39 0 „ 50 0
1883 . .	65,262 . .	39 6 „ 48 0 . .	38 0 „ 45 0
1884 . .	69,029 . .	33 6 „ 45 3 . .	33 6 „ 40 6
1885 . .	52,595 . .	25 6 „ 34 0 . .	24 0 „ 33 3

* Casks 7 cwt. each.

PALM OIL.—LONDON STATISTICS FOR THE UNITED KINGDOM IMPORTS.

1885. Tons.	1884. Tons.	1883. Tons.	1882. Tons.	1881. Tons.	1880. Tons.	1879. Tons.	1878. Tons.	1877. Tons.	1876. Tons.
45,500	41,291	37,175	40,077	40,987	51,318	43,468	32,915	44,863	43,224

PALM OIL IMPORTS INTO LIVERPOOL.

1885. Tons.	1884. Tons.	1883. Tons.	1882. Tons.	1881. Tons.	1880. Tons.	1879. Tons.	1878. Tons.	1877. Tons.	1876. Tons.
40,354	42,651	35,804	39,114	38,526	45,787	38,793	35,064	38,900	38,648

PRICES, 31ST DECEMBER EACH YEAR.—BONNY AND LAGOS.

	1885.	1884.	1883.	1882.	1881.
	£ *s. d.*	£ *s. d.*	£ *s. d.*	£ *s. d.*	£ *s. d.*
Bonny .	22 5 0	29 0 0	38 5 0	33 12 6	29 7 6
Lagos .	26 0 0	29 15 0	40 10 0	35 0 0	30 0 0

	1880.	1879.	1878.	1877.	1876.
	£ *s. d.*	£ *s. d.*	£ *s. d.*	£ *s. d.*	£ *s. d.*
Bonny .	27 15 0	31 0 0	32 0 0	35 15 0	37 5 0
Lagos .	30 0 0	34 0 0	33 2 6	38 10 0	38 10 0

Copra.—The fictitious prices which ruled during the speculative combination in Marseilles until the latter months of the year 1885 directed the greater portion of available supplies to that market, and the business here was principally confined to exports to Russia. For home crushers there was little or no margin, considering the ruling prices obtainable for their oil. The accumulation of stocks at Marseilles are so large that now the market there has given way; there is very little prospect of any immediate improvement in present prices in London. The arrivals in Marseilles during 1883 were 18,000 tons; in 1884, 29,000 tons; and in 1885, about 40,000 tons. Prices opened in London for Singapore at £16 @ £16 10*s.* ex warehouse, but for steamer shipment to Marseilles £17 10*s.* c. f. and i. was paying. Lately sales have been made of parcels on passage to the latter port down to £14 c. f. and i., while the spot value here is now £15 15*s.* @ £16. Australian we quote £15 5*s.* Sydney sun-dried, £15 5*s.*; kiln-dried, £14 10*s.* Ceylon, £15 10*s.* Zanzibar, £14 10*s.*

Average prices, 1885:—	Jan.	Feb.	Mar.	April.
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
Australian . .	16 5 0	16 5 0	15 15 0	15 15 0
East Indian . .	15 10 0	15 10 0	15 7 6	15 5 0

	May.	June.	July.	Aug.
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
Australian . .	15 15 0	15 15 0	16 0 0	16 0 0
East Indian . .	15 5 0	15 5 0	15 12 6	15 10 0

	Sept.	Oct.	Nov.	Dec.
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
Australian . .	16 0 0	16 0 0	16 0 0	15 15 0
East Indian . .	15 12 6	15 10 0	15 10 0	15 7 6

Ground Nuts.—Our supplies were very small, and met with but little demand. Madras in January 1885 ruled at £11 @ £11 5*s.*, while the nominal value of March–May steamer to United Kingdom or Continent is now £9 sound delivered ex ship. Zanzibar: several small parcels have sold at £12 10*s.*, down to £11 10*s.*, present value. The import of all descriptions into Marseilles was 20,000 tons in excess of 1884.

Lagos Palm Kernels.—Business done lately in Liverpool at £8 5*s.* @ £10 2*s.* 6*d.*, a decline of £2 per ton on the year.

Cocoa-nut Oil.—The exceptionally low values of tallow and other soap-making products seriously crippled the trade in this article. The import into the country in 1885 shows a falling off of about 3,300 tons, and the consumption a considerable decrease, the Continent alone taking about 2,500 tons less than in 1884. The great decrease was in Ceylon oil, the shipments for the year ending 30th September amounting to only 4,000 tons as against 8,200 in 1884. Cochin was within 240 tons of 1884, but large quantities of this were simply on Continental account, and transhipped on arrival here without coming on the market. Our supplies from Mauritius were heavier than usual, and, with the exception of June and August, the market was fully stocked. Values realised compare most favourably with other descriptions. With the present small stock and limited quantity afloat there should, with the slightest improvement in trade generally, be a firmer and better tone.

	Jan.	Feb.	Mar.	April.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Average price of Cochin	32 15 0	32 10 0	32 10 0	33 10 0
Average price of Ceylon	29 0 0	28 15 0	28 0 0	28 0 0
Average price of Mauritius	29 10 0	29 0 0	28 10 0	28 10 0

	May.	June.	July.	Aug.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Average price of Cochin	33 15 0	33 0 0	32 0 0	31 12 6
Average price of Ceylon	28 0 0	27 15 0	27 7 6	27 0 0
Average price of Mauritius	28 10 0	—	28 10 0	—

	Sept.	Oct.	Nov.	Dec.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Average price of Cochin	31 7 6	31 0 0	30 15 0	30 0 0
Average price of Ceylon	27 0 0	27 15 0	27 5 0	26 5 0
Average price of Mauritius	28 5 0	28 5 0	28 0 0	27 15 0

	1886. Tons net.	1885. Tons net.	1884. Tons net.	1883. Tons net.	1882. Tons net.
Afloat from Cochin and Ceylon by last advices	1,092	1,492	3,010	1,532	2,128
Landed from 1st Jan. to 31st Dec.	—	4,393	7,782	8,078	6,001
Delivered from 1st Jan. to 31st Dec.	—	6,101	8,958	10,151	8,721
Stock, 1st Jan. (Foreign)	1,532	2,671	4,176	6,192	8,851
Price of Cochin	£30	£32 10s.	£33 10s. @ £34	£35 10s. @ £36	£29 @ £33
Price of Ceylon	£26	£29	£33	£31 10s. @ £31 15s.	£25 10s.

	1881. Tons net.	1880. Tons net.	1879. Tons net.	1878. Tons net.	1877. Tons net.
Afloat from Cochin and Ceylon by last advices	4,250	4,012	3,091	1,248	3,183
Landed from 1st Jan. to 31st Dec.	10,645	12,307	7,764	4,103	7,466
Delivered from 1st Jan. to 31st Dec.	8,132	8,556	6,263	4,679	7,775
Stock, 1st Jan. (Foreign)	6,360	2,580	1,070	2,205	2,331
Price of Cochin	£33 10s.	£40 @ £40 10s.	£47 10s.	£43 10s.	£40 @ £41
Price of Ceylon	£31 10s.	£36 10s.	£45 10s. @ £46	£38 10s.	£37 15s. @ £38

GUMS, RESINS, AND ANALOGOUS SUBSTANCES.

By THOMAS BOLAS, F.C.S.

CANADA.

LARGE and varied as is the collection of exhibits, showing the wide range and magnitude of production in the Dominion of Canada, resins and gums are not by any means well represented. The tree yielding Canada balsam (*Abies balsamea*) is mainly valued as a timber tree by the Canadians, the extraction of the balsam being a very small industry, and mainly confined to the St. Lawrence Valley. Little or no balsam is exported from Canada, but locally it is much esteemed as an external application for bruises, and when administered internally it is supposed to give strength to the chest, and to give power for axe-swinging. The balsam accumulates in small masses between the epidermis and the true bark.

Tamarack gum from the *Larix Americana* or black larch, is easy to collect in the tamarack swamps, and could be exported if the inducements were sufficient. Apart from its use as a chewing gum, almost its sole application to industry is for coating canoes on the outside.

Tar in Canada is obtained by burning the roots of *Pinus strobus* (white pine) or *P. resinosa* (red pine), in pits, and oil of turpentine is distilled from the roots of the same trees. These industries are carried on in Quebec.

Canada has extensive factories, using up resinous bodies imported from other countries, and I may refer to the extensive exhibit of the Canadian Rubber Company of Montreal, this firm showing a well-assorted selection of calendered goods, boots, and carriage cloths. Their representative informed me that 5000 pairs of rubber boots or shoes, and 1000 yards of calendered carriage cloth per day, are sometimes turned out. The rubber rollers adapted for use on printing machines, exhibited by this firm, deserve mention on account of the suitable quality of the rubber and the accuracy of finish. From what the agent told me, I gather that rubber inking rollers are more extensively used in Canada than in England. The varnish factories of the Baylis Manufacturing Company, Montreal, and of McCaskell of Montreal may be mentioned as having sent exhibits; that of the first-mentioned firm included a selection of the materials used in varnish making.

NEW SOUTH WALES.

The hard and brittle resin of the *Xanthorrhœa hastilis*, a tree-fern of the Colony, known ordinarily as grass-tree gum or gum accroides, was shown by W. H. Cook, and this material finds application in the making of

sealing wax, lacquers, japanners' gold-size and similar preparations. Some of the samples shown are lighter in colour than the light shellacs of commerce, but other samples are of a deep-red tint, and when dissolved in alcohol make a capital stain for wood. The dark samples contain however a good deal of woody matter insoluble in alcohol.

The other New South Wales gums shown were wattle-tree gum (acacia), and the astringent blood-wood gums; these latter being gums of a kind more extensively represented in the Queensland department.

VICTORIA.

The collection of oils, gums, and resins exhibited by Joseph Bosisto, well represented the resources of the Colony in these respects, and I may allude first to the gum of the *Eucalyptus rostrata*, which is readily soluble, and is valued as a mild mucilaginous astringent. The more powerfully astringent Australian kino from the *Eucalyptus resinifera*, the resin of the *Xanthorrhœa australis*, which is light coloured and capable of extensive use as a substitute for shellac, and an exceptionally clean and bright-coloured sample of the resin of *Xanthorrhœa hastilis*, may be alluded to, and this latter should find a ready market for making lacquers and as a substitute for shellac. Worthy of special mention is the "Victorian Sandarach," from the Murray pine—*Pinus callitris*. These products are abundant, and an increasing commerce in them may be expected.

SOUTH AUSTRALIA.

Among the exhibits of this Colony I found a few samples of acacia gums, but nothing of special interest as in any way characteristic of the country.

QUEENSLAND.

In the Queensland Court there were numerous interesting specimens of the gums and resins of the district, exhibited by F. M. Bailey, Colonial Botanist, and by Dr. Joseph Bancroft; the specimens exhibited by the latter gentleman having been purified by artificial means. Mr. Bailey's exhibit included numerous samples, and appeared to be thoroughly representative of the Australian gums. It included non-astringent gums of the Arabin type, the so-called wattle-gum, and a sample marked black plum-

tree gum. Neither of these is of such a quality as would attract purchasers in Great Britain except at a low price; the mucilages, formed by dissolving them, being poor and stringy. The semi-astringent and highly astringent or kino-like gums were well represented. A series of iron-bark gums (*Eucalyptus siderophlia* and *E. crebra*) was shown, some of which contain kino-tannin to the extent of over 70 per cent. The stringy-bark gums (*Eucalyptus acmenioides* and *E. Baileyana*) are similar in character, but the samples shown contained generally less of the astringent element than the iron-bark gums which were exhibited. The blood-wood gum, obtained from the *Eucalyptus corymbosa*, is, if one may judge by the samples shown, far less astringent than the iron-bark gums, and the following particulars regarding it are given by Dr. Bancroft: "The gum, which at times exudes in great plenty, is a bright-red fluid of the consistency of treacle. It often becomes imprisoned between the layers of the wood, and in felling a tree the workmen have occasionally to wait some time for the fluid to run out, so greatly does the fluid interfere with the use of their tools. Often this imprisoned gum sets hard among the woody layers and may be broken out in quantity. The gum of the blood-wood varies from being soluble in water, to complete insolubility both in water and alcohol. The recent gum is bright-red, brittle, and reduced with ease in the mortar to a fine pink-white powder. It is then very astringent, and leaves after solution in cold water a little whitish, insoluble, powdery substance in the bottom of the vessel."

The gum of the Gum-topped Box (*Eucalyptus hemiphloia*) is amber-coloured, not very astringent, and soluble in water when recent, and not very similar to this is the spotted gum from the *Eucalyptus maculata*, this being largely resinous in its nature. The following are extracts from a report on a sample by K. T. Staiger, dated Brisbane, 7th January, 1886: "The gum is totally soluble in alcohol, 60 per cent. is soluble in boiling water, and 40 per cent. insoluble. The watery solution possesses the flavour of gum benzoin, and contains benzoic acid, also catechin. The gum insoluble in water is of a sticky nature. When dissolved in alcohol, and the solution evaporated in the air without artificial aid, a sticky, clear, reddish brown, tasteless gum remained. If this is treated with ether, the sticky part of the gum goes into solution, and a dry, clear, reddish, tasteless gum remains, possessing the properties of shellac."

The gum of the Moreton Bay Ash (*Eucalyptus tessellaris*) contains nearly one-fourth of its weight of a hard resin-like shellac, the remainder being mainly a soluble substance like arabin, and some catechin. The ash in question seems to be a common tree, largely used for the sake of its timber.

The grass-tree resinous gum shown, presumably from the *Xanthorrhœa hastilis*, is very much inferior in quality to that exhibited as coming from other Australian Colonies, some of it containing nearly half its weight of matter insoluble in alcohol.

WESTERN AUSTRALIA.

The gums contributed to the Exhibition by this Colony were—as a rule—generally similar in general character to those already alluded to; but one exceptional specimen was a sweet soft gum which comes from the eastward plains, and is called by the natives Karri. It is supposed to be yielded by a species of Casuarina, and is much sought after by the natives as an article of food. Some portions of the sample exhibited consist mainly of arabin, while other portions contain so much of a deliquescent sugar as to be of the consistency of the printer's roller composition (glue and treacle); indeed the softer portions of the gum closely resemble the roller composition in taste, smell, and general physical characters, excepting that the gum is lighter in colour, and does not liquefy on the application of heat.

The so-called "Black Boy Gum" is a Xanthorrhœa resin of a similar character to the grass-tree gum shown in the other Australian departments, but the samples average a little darker, although none are so dark as the darkest specimen exhibited by W. H. Cook, of New South Wales. These resins should, one would think, have a very extensive use for staining wood of a mahogany colour, and in, at the same time, varnishing it. The colour produced is not nearly so red as that obtained by "dragon's blood," and probably would prove more acceptable in many cases. This resin appears, if one may judge from the samples, to vary in purity very much, a lump from one sample—No. 132*a*—a sample exhibited by the Perth Local Committee, having yielded as much as 90 per cent. of deep reddish, orange shellac-like resin; while a lump taken from sample 133 contained more than half its weight of ligneous matter and a trifle under 40 per cent. of resinous matter.

One may regard the resinous element of the Xanthorrhœa gums as the constituent more immediately to be utilized industrially, as one would suppose the European markets to be open to receive a very large amount of this material, if sold in such a form that the average consumer could use it readily. The crude gum does not look very attractive to the purchaser in the European market, as it contains a large—and what is worse, a very variable—percentage of matter insoluble in alcohol; and its purchase would involve an assay of each consignment, together with the attendant inconveniences, and the possibility of misunderstanding. Apart from this, it must be remembered that manufacturers—especially small manufacturers—have a rooted, and not altogether unreasonable, objection to use a variable article, as it disturbs the routine of their operations. All these considerations—to say nothing of the saving in freight—point strongly to the desirability of roughly purifying the resin before sending it to Europe. A sufficient purification is a very simple matter, and could be well carried out on the spot where the material is found, thus saving expense in land as well as ocean transit. It would suffice to soften the crude gum by heat, and to squeeze the softened resin through cloth or through a fine iron wire netting, such as is used for straining gutta-percha. The heat of boiling water is sufficient for the purpose. The separated resin could well be put on the market as an approximately constant article—varying mainly as regards colour—and one which numberless small producers could use in their trades.

The water in which the crude gum is boiled dissolves out more or less colouring matter, and also astringent or tanning substances, and possibly, if the purification were undertaken on a larger scale, these might be turned to account.

Stenhouse, a good many years ago (*Ann. Chem. Pharm.* lvii. 84), investigated the resin of the Xanthorrhœa, and found that when dissolved in potash or decomposed by hydrochloric acid, there is a deposition of benzoic acid and cinnamic acid, and he found that when treated with nitric acid it yields abundance of picric acid, and it is quite possible that in the case of this material being abundantly imported it may become useful in other ways than as a mere resin. It would be an interesting matter to more thoroughly investigate the nature of the Xanthorrhœa resin.

A gum from the *Eucalyptus rostrata*, the "flooded gum" of the interior, is shown by the Vasse Local Committee. This is used as a tanning material, and is said to be very abundant, but the sample appears to have been rather carelessly collected; it contains an altogether unreasonable quantity of bark and other foreign matters.

A sample given to me as 140, and stated to be from the red gum-tree (*Eucalyptus calophylla*), is apparently a rather good sample of Xanthorrhœa resin, a mistake having probably been made in marking. The real red gums are marked 140*a*, Albany Local Committee, and 139, Dunne Bros., and are mentioned under these numbers in the Western Australian Catalogue; they are kino-like astringents, but contain some resinous matter.

Manna Gum, No. 129, in the Catalogue, is a brown acacia gum of fair quality for an Australian acacia gum, and a better quality is "No. 132 sample of gum-arabic," bearing the name of C. E. Dempster, of Newcastle. There is also Manna gum, No. 131, of fair quality, exhibited by the Perth Local Committee.

Cabbage-Tree Gum, No. 131, is a tragacanth-like gum, which swells in water, but does not dissolve. It is catalogued as "not soluble in water, but probably useful in making an oil or spirit varnish," but not being a resinous material, it is useless for such purposes. It might, perhaps, be made to serve as a stiffening material for the calico printer.

NEW ZEALAND.

From New Zealand we have the commercially important Kauri gum, a material very largely used in the manufacture of varnishes. The Kauri-tree is a pine (*Dammara australis*) which forms large forests in New Zealand, and the tree often attains a height of 100 to 150 feet, with a diameter at the base of over 10 feet. The ordinary gum of commerce is the semi-fossilised turpentine of the tree, and is found in masses varying from one to three hundred pounds in weight on the sites of old forests, and at a depth of from five to one hundred feet. The recent gum is by no means so hard as the fossilised gum, and has, moreover, a fragrant smell of the volatile oil present in the original turpentine.

The trade in Kauri gum has very largely increased during the past

thirty years, and the veteran technologist, Mr. P. L. Simmonds, Secretary to the New Zealand Commission, has been good enough to give me the following particulars as to the exports of Kauri from New Zealand during a period of rather more than thirty years :—

Year.	Tons.	Value. £
1853	829	15,971
1854	1,660	28,864
1855	355	4,514
1856	1,440	18,591
1857	2,521	35,250
1858	1,810	20,036
1859	2,010	20,776
1860	1,046	9,851
1861	856	9,888
1862	1,103	11,107
1863	1,400	27,027
1864	2,228	60,590
1865	1,867	46,060
1866	2,535	70,572
1867	2,685	77,493
1868	2,690	72,493
1869	2,850	111,307
1870	4,391	175,074
1871	5,054	167,958
1872	4,811	154,167
1873	2,833	85,816
1874	2,568	79,986
1875	2,230	138,523
1876	2,888	109,234
1877	3,632	118,348
1878	3,445	132,975
1879	3,228	147,535
1880	4,725	242,817
1881	5,460	253,778
1882	5,553	200,369
1883	6,518	336,606
1884	6,393	342,151
1885	5,846	309,838

The main use of Kauri is as a varnish material, but it is also used for incorporation with india-rubber or gutta-percha, and, although in the Exhibition one sees numerous examples of ornamental articles made of the clearer and brighter specimens of Kauri, this is quite a secondary use for the material.

In a recent number of the "Asclepiad," Dr. B. W. Richardson gives some account of its application to medicine. He says (3rd Number for 1886, p. 261) :

"Many years ago Dr. Hammond, of Bournemouth, presented me with a fine specimen of Kauri gum, which one of his sons had brought from Auckland, in New Zealand. In experimenting with the gum thus supplied, I have found that it may be made to perform many useful services in medicine. When the gum is burned,—and it burns briskly,—it gives out a very pleasant odour which destroys the odour of putrefying organic substances most effectively. Dissolved in spirit it makes a fluid which burns in the lamp with good effect. Reduced to a fine powder and shaken with water, it communicates to the water new properties, so that sprayed

in a room it renders the air ozonic. It mixes well with ointments, forms a good combination with soap, and combined with iodine is a useful deodoriser and disinfectant. The gum is from a pine, the Kauri tree, *Dammara australis.*"

The Kauri varies considerably in appearance and colour, the Swamp gum being generally dark, while the dry soil gum is lighter in colour, samples which are perfectly clear and transparent being the exception. It may, however, be mentioned that a piece dug out of a cleft in the sample of Kauri wood sent to the Exhibition by I. Coates of Auckland, proved to be nearly colourless and brilliantly transparent, while some specimens from the recent trees, given to me by Mr. P. L. Simmonds, are also very light in colour. Probably the dark colour of the fossilised gum is mainly due to the penetration of earthy matters.

CAPE OF GOOD HOPE.

The Forest Department exhibited several samples of acacia gum of moderately good to good quality, and it appears that a large quantity might be collected if it were desirable to do so. I also found in the same case a sample of somewhat low quality caoutchouc, or rather of a product which seems intermediate in its properties between rubber and gutta-percha. It is described as india-rubber substitute, and is from a Euphorbia (*Euphorbia castor*). Although the sample shown is very small, it is said that large quantities of the material could be supplied at about 4*d.* per lb. The juice is dangerous to collect on account of its irritating nature, and it is said that those collecting it often lose eyesight from the accidental penetration of the juice. This material seems to be well worth the attention of commercialists. The following particulars are given in the Catalogue:—

Commercially known as Euphorbia gum. The specimens have an odour of caoutchouc, and have been prepared similarly to that substance, viz., the juice was collected in bottles, allowed to harden, and then cut into slices and dried. The samples marked A remained three months in bottle, and those marked B only one month. Euphorbia juice is sometimes used locally (King William's Town) to destroy corns, and as a blister; also by thieves to obliterate the marks on stolen stock. Euphorbia juice rubbed on an animal's hide turns the hair white. Occasionally horses rubbing their flanks against the stiff cactus-like branches acquire white streaks on their coats, the hair becoming blanched where the Euphorbia juice has acted. It may prove to be a valuable substitute for india-rubber. It is very abundant in many parts of the Colony.

STRAITS SETTLEMENTS.

In these settlements there appears to be a possibility of some considerable development of trade in gutta-percha and india-rubber, although at present the production is not very great; and in reference to the existing output the following extract from a letter by Mr. N. P. Trevenen, the Assistant Executive Commissioner, and dated October 6th, 1886, will be read with interest:—

"Referring to the wish expressed by you for information as to the places whence the india-rubber and gutta-percha exported from the Straits Settlements are derived, I have the honour to send you the following:—

From British North Borneo:—

Gutta Percha . .	549 piculs.	Value . .	$22,924
India Rubber . .	12 ,,	,, . .	542

From the East Malay Peninsula:—

Gutta Percha . .	1,527 piculs.	Value . .	$69,480
India Rubber . .	61 ,,	,, . .	4,101

From Java:—

Gutta Percha . .	584 piculs.	Value . .	$27,250
India Rubber . .	38 ,,	,, . .	2,240

From Labuan:—

Gutta Percha . .	245 piculs.	Value . .	$12,280

From Sarawak:—

Gutta Percha . .	2,115 piculs.	Value . .	$125,719
India Rubber . .	358 ,,	,, . .	14,826

From Sumatra:—

Gutta Percha . .	24,966 piculs.	Value . .	$705,843
India Rubber . .	358 ,,	,, . .	14,826

From other islands under Dutch rule:—

Gutta Percha . .	22,081 piculs.	Value . .	$823,873
India Rubber . .	110 ,,	,, . .	5,385

The above is taken from the trade returns for 1884, and show the quantities and values from the different places named during that year.

"One picul is 133 lbs. avoirdupois weight, and one dollar, at the present rate of exchange, is worth *3s. 2d.*

"Sticklac is obtained almost entirely from French Cochin China and Siam, the values from these countries during 1884 being 8,693 dols. and 42,810 dols. respectively.

"It is of course impossible to give any decided opinion as to whether this rate of production can be largely increased, but considering the extent of the two countries in question there seems no reason why it should not. It was on this point that you were more particular in your inquiries."

The white gutta-percha exhibited was of excellent quality and remarkably clean. Some of it was made up into fantastic shapes, clubs, &c.

From Palembang there was a rather fine sample of hardish india-rubber

of a kind which appears to be very suitable for the manufacture of ebonite. This material, although it is, like ordinary rubber, permanently softened and destroyed by sufficient heat to melt it, has when heated a smell rather like gutta-percha than like india-rubber. It is exhibited under the name "Gutta Grek," but no particulars as to the output are to hand.

A vegetable juice sent over in sealed tins and marked "Gutta Horfoot," yields a caoutchouc-like material of fair quality, but it appears that the trade in this is by no means developed. It need scarcely be observed that to send the juice to Europe would involve an enormous waste of freight.

Three samples of a sort of caoutchouc similar to the "Gutta Grek" were shown, but no particulars were obtainable. One of these—marked "Gutta Lumbut, Java, from native states," is hard and sound, while another sample marked "Gutta Jettong, from native states," is soft, sticky, and much oxidised. Another sample, simply marked "33," is hard (that is, hard for rubber) and quite sound, although not very clean. The first and third—like the sample referred to as "Gutta Grek"—when cleaned and mixed with a trifle under an equal weight of sulphur, give, on curing, a very sound and satisfactory vulcanite.

The Dammar from Larut Perak, although rather dark—indeed, decidedly dark—in colour and mixed with foreign matters, is of good quality and exceptionally hard. This material is said to be from a Dipterocarpous tree, and seems to be known indifferently as *Damar degon*, *Damar renkong*, and Cat's-eye Dammar. There is no statement as to price and quantity available.

Stick lac was exhibited by the Government of Perak, and if the samples shown fairly represent the average material available, it would seem that this source of lac is well worth attention; the twigs are thickly coated, and the resin is of good quality.

BRITISH NORTH BORNEO.

In the letter of Mr. N. P. Trevenen, quoted under the heading of Straits Settlements, the export of gutta-percha from British North Borneo is touched upon, and beyond this and the commercially well recognised Borneo Rubber, there is nothing to refer to but a few samples of copal or copal-like gums. One large block of a resin which is either copal (soft), or resembles copal, lay on a shelf in the Borneo Department, but it was unlabelled, and no information whatever could be got concerning it; moreover the authorities in the Borneo Office refused to allow a sample to be taken. The block referred to was about three feet long and a foot broad.

BRITISH GUIANA.

The contributions of this Colony in the shape of the gutta-percha of the Bullet-tree (*Balata*) and of *gum animi* were considerable; but apart from these generally British Guiana may be considered as decidedly rich in gums.

First then with regard to the balata, a quality of gutta-percha, the excellence of which is not fully recognised by consumers. The bullet-tree (*Mimusops balata* or *Sapota Mulleri*) is a forest tree which reaches a height of 120 feet and a diameter at base of 4 to 5 feet. Although to a great extent characteristic of British Guiana, it is found over an area extending from Jamaica to Venezuela and French Guiana; but it is still an open question whether two species are not included under the term bullet (or bully) tree. Mr. G. S. Jenman, the Government Botanist of the Colony, says in a report, dated 1885:—"The vernacular name appears to be applied to two species or sub-species, which are united by Griseback in his Flora of the British West Indies. Young plants of *Mimusops globosa* of Jamaica and Trinidad growing in their gardens, seem to be distinct from the Guiana type."

Jenman in his report (Demerara "Royal Gazette" Office, 1885) gives interesting and valuable particulars regarding the bullet forests and the collection of the material. In speaking of the extensive bullet-tree district, that extends from the Canje to the Corentine River, he says: "Since the days of the first colonisation of Berbice, it has been occupied by wood-cutters; and though so much timber has been got out during the last century, I found the bullet-tree more plentiful there than perhaps anywhere else on my journey." The population seem to be living in a condition approximating to one of peaceful anarchism, Jenman saying:—"The centre of the district is about 70 to 80 miles from New Amsterdam, so that the inhabitants have very little outside intercourse. They live almost entirely to themselves; there being no magistrate or doctor or other official on the River. . . . At Baraccara there is a Presbyterian Mission Station, with a resident schoolmaster; this is visited three or four times a year by a minister. The children assemble on Monday at school, and remain in the neighbourhood with friends till Friday, when they return to their homes. The schoolmaster having been a dispenser formerly, prescribes for the ailments of the children; the older people depending chiefly on their 'bush' remedies."

There seems to be much misunderstanding about the relative values of the gutta from the bullet-tree and that from other sources, and it is very desirable that certain injurious misunderstandings regarding the matter should be cleared up. That as a general thing the crude gutta-percha from British Guiana possesses a greater use-value than the average crude gutta from other sources, I regard as certain and established, and I am inclined to attribute this largely to the higher moral character of the people who collect it; this higher moral character bringing about a corresponding care to deal intelligently and honestly with the material, and an obviation of those adulterations which give the manufacturer so much trouble, and which often seriously injure his machinery. It is because I take this view, that I quote what Jenman has written about the social condition of the people of the Baraccara district.

Admitting the use-value of the product to be above the average of crude gutta, the question arises how it is that, excepting when sold to the actual consumer, it has often, and perhaps generally, realised a far lower price than it should do on its merits.

The reason is, as far as I can gather, that a notion exists that balata is a distinct material, that it is not gutta-percha, but a material having qualities between gutta-percha and india-rubber, a notion for which Dr. Hugo Müller is principally responsible. In my Lectures on the "India-Rubber and Gutta-Percha Industries," published in 1880 by the Society of Arts, I merely alluded to Balata by saying, "The South American bully-tree has, of late years, afforded a considerable supply of an excellent quality of gutta-percha which passes under the name of 'balata.'" Previously to writing this I had quite satisfied myself of the real identity of the so-called balata with the ordinary gutta-percha of commerce, and I thought it quite sufficient to merely allude to balata as "an excellent quality of gutta-percha." But so great is the vitality of the old, and as I distinctly contend, erroneous notion, that Jenman commences his report on the nature of balata by this statement: "Balata is intermediate in character between the india-rubber and gutta-percha. It combines the qualities of both, and is said to be as good as the best combination of these materials that can be made." Jenman, however, is probably not to blame, as he takes his cue from a chemist of such high repute as Dr. Hugo Müller, who, in a report on balata from British Guiana, made at the suggestion of Sir Joseph Hooker and presented to Government, says, "It seems that balata is treated by manufacturers simply as a superior kind of gutta-percha, and therefore its name disappears when manufactured. Nevertheless, balata is distinctly different from gutta-percha, and this is especially manifest in some of its physical properties; for instance, it is somewhat softer at ordinary temperatures, and not so rigid in the cold. In one respect, balata shows a very marked and important difference from gutta-percha, and that is in its behaviour under the influence of the atmosphere, whilst gutta-percha, when exposed to light and air, soon becomes altered on the surface, and changed into a brittle resinous substance, into which the whole of the mass is converted, in the course of time. Balata, on the other hand, is but slowly acted upon under these circumstances. I enclose a piece of balata tissue which has now been in my possession quite six years, and it is still supple and coherent. A similar piece of gutta-percha tissue would have long before now become entirely converted into a brittle resin."

To begin with, Dr. Hugo Müller is quite mistaken when he says that "Balata is somewhat softer than gutta-percha at ordinary temperatures, and not so rigid in the cold." In so far as any given sample of gutta-percha has been carefully collected and well preserved from the air, will it contain more of the plastic principle which has a composition corresponding to the formula $C_{10}H_{16}$, and also more of a volatile, oily, and odorous principle which appears to be metameric with the plastic principle, and these are the circumstances which influence the hardness or softness, not whether the sample has been taken from a tree of the order *Sapotaceæ* in British Guiana, or from a tree of the same order in an island of the Malayan Archipelago. Gutta-percha as imported from the Malay Islands often contains 20 to 25 per cent. of a nearly useless oxidised product $(C_{10}H_{16})2O$,

removable by very patient treatment with hot alcohol; and such a gutta will certainly be much harder and less supple than a carefully collected sample; but at the same time it will be correspondingly far on the road to that destruction by oxidation which all gutta tends towards.

With regard to Dr. Müller's contention that balata resists oxidation better than gutta-percha, and his illustration of this from the fact that a sample of balata tissue remained sound for six years, while gutta-percha would long before have become entirely converted into a brittle resin, I may say that this seems to show that Dr. Müller is hardly aware of the fact that although the nature of the decay of gutta by oxidation is well understood, the exact conditions under which it oxidizes are not by any means clear at present. A sample of gutta-percha may decay to the dusty stage ($C_{10}H_{16}O$) in one year, or the tissue may remain sound for twelve years or more. To illustrate this point, I may quote from my lectures, published in 1880:—

"When submerged in water, or in any way protected from the action of air and light, gutta-percha has little or no tendency to change; while, on the other hand, constant exposure to light, together with alternating conditions of dryness and dampness, is most unfavourable to its well-being. The products formed by its oxidation are of a resinous nature, as in the case of caoutchouc; one of the most notable of these being a body resembling Spiller's caoutchouc resin, and containing 27·9 per cent. of oxygen. It occasionally happens that samples of gutta are met with which resist decay in an extraordinary manner. Here, for example, is a sample of thread which Mr. Walter Hancock has had in his possession for over twenty years, and you will note that it is tough and strong like new gutta. Other samples kept under similar conditions fell into dust as soon as they were touched; and Mr. Hancock tells me that he cannot account for the difference between them."

It may be mentioned as probable that the rapid decay of thin-sheet gutta is often due to the action of ozone, as this reagent attacks gutta (and rubber too, for the matter of that) with intense energy; a thin leaf of gutta falling to dust almost immediately in strongly ozonised oxygen.

Coming on the market as a material essentially differing from ordinary gutta, and under another name, the product of the bullet-tree is considerably handicapped in the market; and this more especially as the supplies have arrived at irregular intervals. The speculating commercialist has frequently availed himself of these circumstances to purchase bullet-tree gutta at a simply nominal price—sometimes only 6 cents a pound—but the manufacturer seldom gets hold of it under the market price for best gutta.

The capabilities of supply in British Guiana seem to be enormous, and if the misleading term *Balata* were dropped, and relations opened directly with manufacturers, an enormous trade could probably be done in this article.

Even though more carefully collected and less adulterated than other guttas, there is still room for improvement as regards the collection, and if some system of coagulation could be systematically employed, the quality of the product would be enormously advanced, or rather one should say the deterioration of the hydrocarbon by oxidation would be minimised. The difficulty is to find a coagulating material which shall be sufficiently cheap, and which, if some of it remains in the product, shall not work mischief.

It might be worth while to send carefully preserved and sufficiently large samples of milk over to this country for examination and experiment.

I may point out that it is desirable to mould the gutta-percha rather in compact masses than thin sheets, as, other things being equal, the oxidation is directly proportionate to the surface exposed to the air and light.*

Very much more might be said as to the condition and possibilities of the gutta-percha industry in British Guiana; but space does not admit of it.

India-rubber was shown in the British Guiana department, and it appears in irregular balls of 2 to 4 inches in diameter. This rubber appeared (with the exception of a few balls which seemed to have been damaged by contact with grease) to be sound and of good quality, although not very clean. There seems to be no certain information as to the origin of this rubber; but there is but little doubt that a good deal of it is obtained from the *Touckpong-tree* already alluded to in a foot-note. The touckpong grows very rapidly, is abundant on the Canje, and a variety growing near the coast has been identified by Professor Oliver of Kew as one of the seventeen varieties of the *Sapium biglandulosum* (Arg). The touckpong is said to be one of the Euphorbiaceous order, and the Pomeroon variety appears to be regarded by Oliver as one not hitherto recognised.

The partly dried juice is boiled in water and made into balls; in former times it has been too much the custom to mix the milk of the touckpong with that of the bullet-tree; but one cannot too strongly insist on the necessity of keeping the two products separate.

A tree called *Barta-balli* yields a very inferior rubber, and from what I can gather, the only thing to be observed with regard to this tree is to suggest to the authorities to keep its product separate from that of the touckpong, if indeed it is considered worth gathering. The admixture of barta-balli milk with the gutta-percha milk is likely to be very injurious.

It seems probable that the touckpong is the same tree which has often been described as the *Hevea guianensis*, indeed generally known as the *Hevea guianensis;* but as regards this matter, there seems to be no very certain information at present.

With respect to the locust gum or gum animi, which is found about the roots of the Simiri or Locust tree, there is little to be said, except that the specimens shown were exceptionally fine. The value of this material is quite understood by varnish-makers.

Karamani or black wax is obtained by the Indians from a tree called mani. It is very hard, and could perhaps be used with advantage as an insulator. In some of its properties it borders on gutta-percha; but requires further investigation than was possible with the small quantity available.

Hyawa gum, said to be obtained by incision from the *Icica heptaphylla*, is a fragrant thus-like resin, which is very fragrant when burnt. As an incense it should, one would think, out-distance most of its competitors.

* Jenman, in the report quoted, refers to the balata milk—for which the collectors receive so much per gallon—having occasionally been mixed with the milk of the tree called by the people Touckpong. Now the Touckpong yields a true rubber; and it may be that some of the samples of balata which were pronounced to be intermediate in properties between gutta and rubber, were prepared from the mixed milks. The collectors should be instructed to carefully avoid any admixture of this kind.

WEST INDIAN DEPARTMENT.

JAMAICA.

This island contributed gum guaiacum—very fine and clean samples—and animi and cashew gum, these being exhibited by the botanical department. Some of the samples of animi were exceptionally clear and good.

TRINIDAD.

Guaiacum gum, mastic and animi, were the principal resinous products shown as coming from this island, and as belonging to another class. I may mention an arabin gum shown as cedar gum. This is not very readily soluble in water, and has a slight flavour recalling asafœtida, but so slight as to be scarcely disagreeable.

Perhaps more interest attaches to the natural pitch from the Pitch Lake than to any other resinous product of the island. It seems that no considerable attempt has been made to utilise the enormous wealth of the Pitch Lake, but it has recently been stated that the old monopoly is brought to an end, and that permission to dig the asphalte is offered by the Government at a royalty of *2s. 6d.* per ton. If this is so, new and large industries will doubtless grow up. The Trinidad bitumen is sensitive to light, and may be used as a ground in photo-etching processes, and, moreover, it makes excellent japans and black varnishes. About 30,000 tons a year appear to have been exported during the past three years.

BARBADOS.

The liquid tar found in this island does not appear to have been made as much use of as one might expect. By its distillation a wide range of heavy paraffin products may be obtained, including lubricating oils and solid paraffins. It is used on the island as a cough medicine for horses and cattle.

GRENADA, ST. VINCENT, TOBAGO, ST. LUCIA, ANTIGUA, AND DOMINICA.

Grenada yields hard and resinous sorts of india-rubber, which are obtained from *Ficus radula*, and from the bread-fruit tree (*Artocarpus incisa*). Gum elemi of light colour and clean quality was shown, and also

cashew extract. The soft resin from the turpentine or gomier tree, *Bursera gummifera*), is a bland and fragrant balsam, which is believed by the inhabitants to have similar medicinal virtues to copaiba balsam. In the St. Vincent exhibit I may refer to the golden apple-tree gum, a soft and dark-coloured arabin gum of low quality, and also specially notice a hard and light-coloured specimen of gum animi, while Tobago contributes cashew extract—rather light in colour—and "cocoa-nut gum," a very insoluble, dark-coloured and unattractive-looking product of the tragacanth type. St. Lucia contributed gomier resin (*Bursera gummifera*) for incense and for torches, and also cashew. Antigua sent the soft balsam of the *Bursera gummifera* already alluded to, and Dominica contributed cashew gum from the *Anacardium occidentale*. The samples shown, although not equal in value to the best qualities of gum arabic, are superior (as regards solubility and freedom from foreign matter) to most Australian gums of the arabin type.

BRITISH HONDURAS.

This Colony produces a sort of hard and resinous india-rubber, said to be from a tree called *toonu*, also a better kind from the *Castilloa elastica*.

SIERRA LEONE.

After alluding to a not particularly good sample of cashew gum, I may turn to an exhibit which has considerable interest. No. 132, mixed gum from the Northern rivers at 2*d.* per lb., No. 133, a cleaner sample of a similar gum marked 4*d.* per lb., and No. 134, a third sample still more carefully selected, marked as sold at 6*d.* per lb. The gum in question is in nodules or tears, and is very similar to a soft copal, and it makes an excellent oil-varnish. Such a gum could be sold readily in this country at very much higher prices than those marked upon the samples. Copal No. 131 was poor and weak; also very dirty. Rubbers No. 135 and 136 were sound and clean, but wet inside; and No. 130, a sample of benzoin, was perhaps a trifle below average. Wax-gutta, No. 137, exhibited by N. B. C. Sibthorpe, is a brittle and dark wax, something like the Karamani of British Guiana. No information was given as to its origin.

THE GOLD COAST COLONY.

Samples of copal were shown, several of which were remarkably clean and good. India-rubber of excellent quality was also exhibited, and as the possible yield is said to be large, one may expect considerable trade to be done in this article.

LAGOS.

"Ogea gum" shown in this department is a rather low class gum of the copal type, and the copal shown was by no means clean. On breaking the lumps an aqueous liquid with an acid smell flows from the cavities.

GAMBIA.

Several qualities of acacia gum, ranging from fair to indifferent, were shown; also an undescribed resin in small tears. It is similar to ordinary sandarac, but harder and less brittle.

CYPRUS.

Samples of cedrus gum, No. 279, were exhibited, this being a fragrant turpentine suitable for use as incense.

COTTON.

By JOHN BUTTERWORTH, Examiner in "Cotton Manufacture" to the City and Guilds of London Institute.

THOSE who are conversant with the history of our cotton trade will remember that, in its earliest days, we received our supply of cotton solely from the various districts on the Mediterranean, under the name of Levant cotton, and this seems to have been the only class of cotton available up to the middle of the last century; but about that date supplies begun to come in from our West Indian Colonies, and these increased so rapidly, that at the beginning of the present century they had almost supplanted the Levant cottons. Some idea may be gathered of the large increase of the supplies from our Colonies, from the fact that in 1782 a panic was caused in Manchester by the importation, from March to May, of 7012 bags, or about 1,400,000 lbs., mostly from this source, causing a great fall in price. The excellence of the cotton from these Islands at the above period may be judged when it is known that the Society of Arts granted their Gold Medal to Mr. Andrew Bennett, of Tobago, for the best sample of West India cotton. The cultivation of the cotton plant on these Islands is of great antiquity.

At the discovery of Guadaloupe, cotton thread in skeins was found everywhere, with appliances for weaving it, and at many of the Islands the discoverers were met by the natives in canoes offering to barter the skeins of thread.

Although the growth of cotton in these Colonies has given place to that of sugar and other products, their growing capabilities seem to be still maintained, for the sample from Tobago in the Exhibition was of an excellent colour, and capable of spinning into number 60's; in grade it was equal to good Orleans. The sample shown in the St. Vincent Court was almost equal to the above in colour, but not so good in staple, yet it was a good serviceable cotton.

St. Lucia and British Honduras both showed good stapled samples, but not so good in colour; both samples partook of the character of White Egyptian, being a little harsh, but in length of staple they are nearly equal to that of Egyptian, and would spin into similar counts or numbers of yarn: the harshness noticeable in the two last samples may be due to want of selection of the seed, or some peculiarity in the soil.

Dominica also showed a small sample that was quite equal to a good class of White Egyptian, and would spin into as high a range of counts.

The only sample shown from the Bahamas was one of the Nankeen variety. This variety seems to be grown more or less in several of our Colonies, as well as India, but this sample was of a better quality than those from our other Colonies or from India, where it seems to be grown in the greatest abundance. Contrary to most samples of this class of cotton, it had a very glossy appearance arising from its longer and softer staple, and it is capable

of being spun into numbers ranging from 40's to 50's. Very little Nankeen cotton is imported into this country: it seems to be retained in most of the Colonies for native manufacture, but in the case of this from Bahama I was informed by the assistant commissioner that attempts are being made to introduce cloth made from their Nankeen variety into India, with the object of its taking the place of a dyed cloth used for the summer clothing of the British troops; how it may compete with the Indian cloth in point of colour I do not know, but in regard to the quality of staple it is much superior to the Indian Nankeen growth, and equal to the best of their white varieties. It would give a stronger though thinner cloth than the short coarse staples of Nankeen cotton from other Colonies, and as to the colour, if lighter shades are required than this cotton from Bahama would give when spun alone, any shade could be got by mixing white cottons with it.

Finding only this sample from the Bahamas, one can hardly believe that the imports from these Islands reached 1,113,392 lbs. in 1857, but from some cause or other the imports from this section of our Colonies have fluctuated very much. Nevertheless, it is quite evident that the qualities necessary for the growth of good cotton are there, in the event of any future necessity of the mother country. In fact this may be said of the whole of the West Indian Colonies. It is indeed worth noting, that in the first few years of America's attempts to introduce her cottons into this country she was compelled to make her shipments by way of the West Indies, which proves that these Islands were supplying us with cotton at that date, 1793, quite equal to the growths of Louisiana and the neighbouring States of the American Union. Again, the falling-off of the supply of Levant cottons, on the introduction of those of the West Indies, proves the superiority of the latter. Some idea may be gathered of their capacity for growing cotton, from the fact that the exports to this country in 1787 reached 6½ million lbs. and in 1815 they had swelled to 11¼ millions, yet this was considered as only a tithe of their producing power.

British Guiana showed two varieties of cotton: one was evidently a Brazilian variety and seemed to retain the features of that class of cotton in its harshness; it was fully grown, however, and of a good average staple; another sample was evidently grown from Sea Island seed, and if gathered or picked freer from leaf and dirt it would be almost a pure white, but it had one serious defect in the irregularity of the length of staple. Spinners avoid this class of cotton, as it is difficult to manipulate, hence it has a lower value. The sample had a fine silky staple, and in that respect would make a nice yarn. This Colony I believe has extensive tracts of land adapted for cotton-growing, which, with the improved methods of cultivation, selection of seed, and ginning, would produce an article in bulk and quality that would be hard to beat.

In the Fiji Court were exhibits of cotton, both ginned and in the seed. Cotton from the Islands forming this Colony excited the attention of spinners in this country to a considerable extent on its first introduction, on account of its fineness and extraordinary length of staple; and at that date, 1865, it sold at a premium above other grades of Sea Islands, partly owing, no doubt, to the scarcity caused by the war between the Northern and Southern States of America. It had, however, the same fault as the sample from British Guiana, irregularity in length of staple; in other respects it seems to have suited spinners well. The present exhibits had this fault of

irregularity, but I was told by the commissioner that a way out of the difficulty has been discovered by selecting the seed before planting, and taking only the small kidney seed for sowing. It is important that this fact should be made known if the difficulty can be so easily removed, for no Colony, I believe, has yet produced cotton that equals this sample in length of staple. Great care is required in the ginning of the above class of cotton; the saw-gin that is now so largely used for ginning the medium and short staples is totally unfit for ginning Sea Islands. The only gin that has effectively ginned this cotton, without injury to the staple, is the roller and knife gin; but the amount of work it has only been able to do in a given time has long been felt to be a drawback to this machine. This defect seems now likely to be overcome to a considerable extent by a gin, the invention of an American, that is just being introduced by Messrs. Platt Bros., of Oldham; the weight of clean cotton that this gin is able to produce on Sea Islands being stated to be nearly double that of the single-knife roller gin. I have seen this gin at work, and it seems to answer admirably for long staples, such as Sea Islands, requiring delicate treatment.

In the Natal exhibit, samples were shown under the name of Sea Islands, about which there must be some mistake, as they did not carry any of the characters of that class of cotton: the fibre was wiry and shorter than Sea Islands, and again, the seed, when divested of the fibre, had not the character of Sea Island seed, which is bare and black, while this was covered with a green, short-tufted fibre. Planting may have commenced with Sea Island seed, but if so, the plant is evidently hybridizing, perhaps with the native or some other variety. The fibre produced, however, is long and strong, and would class well with Egyptian, spinning a similar range of numbers.

A sample was also shown from West Africa (Gold Coast). No name was given to it, but it had evidently been grown from Brazilian seed, as the seeds were attached together and kidney-shaped, which is characteristic of Brazilian seed; in class it would grade about equal to Brazilian, spinning about the same range of numbers.

In the Mauritius Court was shown a small sample in the seed that would class very well with a good grade of Orleans, with similar capabilities for spinning.

A very fair sample was also shown by South Australia which would class with some of the better grades of American, and would spin numbers up to 50's; the staple is even-running and clean, and would make a nice weft cotton up to the above numbers. I remember seeing a sample of Queensland cotton some years ago that would class with the better grades of Sea Islands; no large quantity appeared on the market, and it disappeared as suddenly as it made its appearance, probably owing to the market price being too low. These samples prove that the Colony is capable of growing cotton that will stand at par with much of what America now supplies us with.

Samples were shown from several Colonies which were designated "Silk Cotton;" no doubt the name is given to it from its resemblance to cotton fibre; however, it is very different to cotton fibre in structure, and could not be used as such. Two or three years ago samples of this material were sent to Manchester with a view of ascertaining its commercial value for spinning purposes. It proved, however, to be very limited, the attempts

made to spin yarn from it failing, unless a large percentage of real cotton was mixed with it.

An examination of the two fibres examined under the microscope shows at once the advantage that cotton has over the fibre in question. A fibre of cotton is always more or less flattened, and possesses a natural twist peculiar to itself, while the fibres in the samples shown as "silk cotton" are almost invariably straight cylindrical tubes. The natural twist in the former gives it a tenacity and strength when made into a thread that the latter could never possess.

Turning now to one of our lately acquired Colonies, that of Cyprus, I found two or three very fair samples shown in the Court devoted to this Colony. It must be remembered that, though Cyprus is only young to us as a Colony, her reputation as a cotton-producing country is very old; for we have records of her exporting cotton to this country before the middle of the sixteenth century, and the cultivation seems to have been kept up more or less from that period to the present. At that date it must have compared very favourably with Smyrna cotton, as it appears to have been exported along with it under the head of Levant cotton. It is pretty well known that in spinning capacity these cottons are about on a par with our East Indian cottons, but in colour they are often superior to many of them. I have known Smyrna cotton mixed with low grades of American to improve the colour, and in respect of colour and even length of staple, the samples shown in this exhibit from Cyprus are equal to those from Smyrna.

It appears that attempts were made some ten years ago to improve the staple of Cyprus cotton by planting seed obtained from New Orleans, and for three or four years good results attended the effort; but now the plant seems to have hybridized with the native plant, and the fibre has gone back to its stubborn harsh character. Renewed attempts have been made to procure seed from the same source by those interested in the welfare of the island, in order to again improve the growth, but for some unexplained reason they have failed. It may be as well to mention here that every year less and less cotton finds its way down to New Orleans, more and more being collected at various centres in each State and shipped direct from there. Oil mills have sprung up at all these centres, and to these mills the surplus seed is now sold that the oil may be extracted and made into food for cattle. Possibly, if the matter were put into the hands of some well-known shipper at one of the principal towns of Mississippi or Arkansas, they could procure and ship the necessary seed from some of the rich bottom lands so abundant in those States.

Repeated experiments in the growth of cotton in various countries prove that great improvement has been brought about by the introduction of higher-class seed, but there is proof in many instances that to keep it up to a certain grade it is necessary to renew the seed every three or four years. Even the American planters have been obliged to have recourse to this plan to keep up their style.

I might just mention for the information of those intending to follow up cotton-growing in the Colonies that the extracting of the oil and the manufacture of seed-cake for cattle-food has now become a large industry in the cotton States of America. In a run through these States two years ago I saw these oil mills in every cotton centre. Before the seed is crushed, it

is now cleared by machinery of all the short fibre that is still left attached to it after ginning, and none of the evil effects are now felt that arose from giving the uncrushed raw seed to the cattle as formerly; another benefit of this industry will be found in its cheapening the cost of growing, as the planter now realises 10 to 12 dollars per ton for surplus seed that formerly he could only use as manure.

The Malta exhibit consisted of two varieties of native cotton: one white and the other red (the Nankeen variety). The white bore the character of the Levant cottons, of which I have no doubt it is a variety. In this case also, if facilities were offered for acquiring higher-class seed, great benefits would doubtless result, both to the native user and the planter, in giving a greater bulk of a better material at no more cost in labour, whereas I am told that at present no more is grown than will serve for native use. The white variety is of a very good colour and worthy of improvement; the Nankeen variety shown in this Court has a longer and softer staple or fibre than the white, making it more suitable for spinning a level strong yarn, and this also seems to be consumed in native spinning and manufacture.

WOOLS.

By F. H. BOWMAN, D.Sc., F.R.S. Edin., F.L.S., F.C.S., F.R.M.S.,
President of the Society of Dyers and Colourists.

No department in the whole of the Indian and Colonial Exhibition is of greater interest, or of higher industrial importance, than the magnificent exhibit of Colonial wools which were displayed in the various Courts.

These wools indicated, in a striking manner, the very great advance which has been made within recent years, not only in the quality and quantity of our Colonial resources, but also the application of scientific agriculture, resulting in the production of a sheep which possesses peculiar characteristics of its own, and unites large size and heavy fleece with the finest quality of wool.

The change in the requirements of fashion which demands soft and supple goods in the place of lustrous and stiff fabrics, has caused a large demand for fine and soft wools, which are only produced in a limited degree in this country by the Down and other short-woolled sheep—the long bright-haired wools, for which the soil and climate of the United Kingdom are so well suited, being comparatively neglected or confined to other uses than the great textile trades for dress fabrics.

This demand has undoubtedly been of very great value to all our wool-producing Colonies, because in them the climatic and other conditions are most admirably suited for the growth of the soft and non-lustrous wools. In addition to this, the farmers in the United Kingdom have always been striving to attain two objects rather than one.

They have a large and remunerative market for the mutton as well as the wool close at hand, and hence they have been endeavouring to raise sheep which will have a heavy dead weight and early maturity, while, to a certain extent, the wool is a secondary object; whereas in most of our Colonies the carcase has been a secondary consideration, and the attention has been almost exclusively directed to the production of the highest class of wool. The improved means of communication, and the various processes for freezing the meat, even without taking into consideration the large and growing trade in tinned meats, are now modifying these remarks; but the general result up to this date has been, that the Colonial farmer has had every inducement to consider the quality and quantity of wool, as the prime consideration in sheep culture, and has acted accordingly.

This careful attention to quality of wool was evident in a very large number of the exhibits in the several Courts; and while there were in some cases exceptions, it must be borne in mind that the wools were derived from a very wide range of country, and were intended to show, not only the types of wool which pertain where the greatest care and attention is bestowed, but also those which exhibit that wider range of production, in which quantity, with moderate degree of quality, is aimed at. Thus it could scarcely be expected that the same quality of wool would be exhibited

from the more distant parts of any of the Colonies where the sheep are permitted to have a very wide run of land, and where the supervision and attention must necessarily be less than in districts where the sheep are more domesticated, and since they are confined within properly fenced pastures, subject to greater control.

In addition to this, it must be remembered that the Colonies range over a large portion of the globe, and exhibit a very wide difference in geographical conditions, climatic influences, and general aptitude for sheep-farming. Also that while in some of the Colonies the staple industry may almost be said to be sheep-farming, in others it is only of secondary importance and auxiliary to other agricultural pursuits.

The length of time during which a Colony has been founded, and the character of the sheep which from various causes were at first introduced, also influences the wool production, because, as a general rule, the highest possible perfection is usually attained in those districts where the special industry has been longest in operation, and where therefore the knowledge and skill requisite for its prosecution are most general. Here skilled overseers are most readily obtained, the physiological and scientific part of the subject is best understood, and the competition amongst the growers reaches its greatest height, a cause which tends to individual effort to excel, because this becomes not only a source of distinction, but also a special source of profit.

This competition serves a most useful function in compelling a continual advance; and if the Colonial Exhibition does nothing more than enable the various sections of our vast empire to compare their relative positions in the various branches of industrial enterprise, it will have served a useful purpose, for each has much to learn from the other, and the comparison can be made of the greatest advantage by any who will take up any special branch, either of agriculture or any other department, and carry the investigation into all the details.

In presenting this report on the wools of the Exhibition, it has been a matter of extreme difficulty to determine the best way in which it should be prepared, so as to render it much more than a mere official catalogue of the different exhibits, with a short comment on each, and to embody such information and suggestions as should make it practically useful to those who might read it.

A comment on each of the exhibits would be a comparatively easy matter, but to be of the widest value, this should be accompanied as a preliminary, by a statement of the general principles upon which the quality and value of wool is determined, so as to permit those who wish to re-examine their own wool for themselves, and thus trace the various characteristics upon which rest success or failure, to attain the highest possible standard of perfection. This is of more value than any individual criticism or commendation, because it covers every possible condition, and may be used for reference when the effects of the exhibition itself have passed away.

If space permitted, even more than this might be attempted. One of the great difficulties in reporting upon an exhibition of wool, such as is displayed at South Kensington, is the fact that all the samples exhibited are more or less picked specimens.

This report is based upon these examples since it was quite evident

that in many instances they indicated a considerably higher degree of perfection than could be expected on the commercial scale. Hence the remarks made must only be regarded as applying strictly to the examples which were exhibited, and not as indicating the general character of any name, mark, or district.

This does not mean that very large numbers of the exhibits are not a fair representation of wools, which could be supplied in bulk, and equal to the sample shown, but that any fleeces showing marked defects either in breed or management have been excluded. All the exhibits were therefore of their respective classes of a first-rate order, and only in two instances in the whole of the Exhibition were there very marked defects in the character of the wool shown. One instance was very bad, but it is quite possible that a further knowledge than could be obtained from the Official Catalogue or by personal inquiry would have revealed some extenuating circumstances, as the same defects are sometimes found in individual cases, even in well-kept flocks, and had probably escaped detection by the exhibitor. Otherwise all the exhibits were so good that they might be said to indicate the high-water mark of our present possibility of sheep culture, and most of them might be taken in their respective classes as samples worthy of imitation by all who seek to excel as wool-growers. Indeed, taken as a whole, probably no exhibit of wool ever equalled it, and a feeling of astonishment was created in the mind that such results could have been attained within the comparatively short period since the foundation of many of the Colonies. In judging of the quality of the wool, such characteristics as evenness of length, soundness of fibre, softness, and curl, have all to be taken into account, and in all these respects many of the exhibits—I might indeed say, the great majority of them—displayed all these desirable characters in their highest state of perfection.

Each of the Colonies have generally their distinctive character displayed in their wools, and those who are accustomed commercially to their use know how very marked this is in some cases. Most of the wool was shown in its natural condition, that is, in the grease or simply washed with water and not scoured, and it may be noticed in passing that this is very much the best way of sending wool which has to be compressed in bales. The natural grease or suint, which is secreted along with the wool, serves the purpose of protecting the delicate surface of the wool-fibres from attrition and felting; and the pressure they are subjected to in packing, and the vibration in transit, is therefore comparatively harmless, whereas if the wool is scoured beforehand, it can never be opened out again with the same degree of freedom, and can never be manipulated with the same degree of perfection. When once the natural fat has been removed from the fibres, the sooner they are passed into the process of manufacture the better. The greatest care should be exercised by the farmer as to the nature of the dips and washes and smears which he uses for the sheep, because many of those which are in common use are most deleterious to the wool, and are the frequent cause of subsequent difficulties in manufacture and dyeing. It cannot be too strongly urged that the more natural the condition of the wool the better for all concerned, and that care and attention to cleanliness and condition in the sheep themselves will always amply repay the trouble required to secure it. This matter ought to receive the very best attention on the part of all wool-

growers, since it is notorious that many brands of Colonial wool would stand far higher in the market if more care was bestowed upon the condition of the wool and its classification. Although many of the defects may afterwards be removed, the process always costs both time and money, and in many cases the wool suffers in the operation. Special note ought to be made in regard to scoured wools of the necessity for preventing the introduction of any foreign substances into the wool, such as hemp, or other vegetable matter, from the bagging, or any other source. In the process all rollers should never be wrapped with hemp, cotton, or any other foreign material, because even minute quantities present in the wool are a fatal objection to its use in a large number of instances, and may prove ruinous to the user, because they will not take the dye along with the wool, and spoil all the goods into which they are introduced.

Never before, perhaps, has such an opportunity been presented of studying the different classes of wool in their geographical relations, and of comparing the differences exhibited by the same wools, or rather by the wools from the same class of sheep under a wide range of climatic conditions, and this introduces questions of a deeply interesting scientific, as well as industrial importance. It is not an easy matter to do this, because in one sense to perform such a work satisfactorily the report ought to be accompanied by the possibility of examining the exhibits along with the report, so as to enable those who are interested to verify the facts and deductions for themselves, which is impossible after the close of the Exhibition.

If we include the small series of wools which were seen in the Indian Court, we are brought into contact with the sheep in all stages of its wool-bearing development from the time when the fibrous covering probably differs little from that which characterised the primitive sheep, down to the latest stage of its improvement, as seen in the magnificent wools of the Australian Colonies or the long wools of New Zealand.

Of the primitive sheep we know nothing. It passed away before the dawn of history, since we find the bones of the sheep indicating a more or less state of domestication mingled with the earliest remains of pre-historic man, as revealed in lake and cave dwellings. The existence of a race of wild animals, such as the Aoudad (*Ammotragus tragelaphus*), the Argali (*Ovis ammon*), and the Moufflon (*Ovis musmon*), both in Asia, Europe, Africa and America, which possess a similar affinity to the sheep that the wolf does to the dog, has led some naturalists to suppose that they may have been the original stock out of which the domestic sheep has been attained by cultivation and breeding; but the probability seems, from the structural differences, to be much greater that these wild animals themselves, along with domestic sheep, have had in the remote past a common ancestor from which they have diverged in different lines during the course of ages. Few creatures seem to be of greater variety than the sheep, and this tendency to variation has no doubt been greatly serviceable in the improvement of the breed, and tended at an early period to the complete differentiation of the domestic sheep from its wild progenitor. Equally uncertain with the method is also the place of its origin, because the genus is so widely scattered over the different parts of the globe that its members must evidently have been for a long period of time removed from the original habitat—a period during which local variations have had time to become

permanent characteristics, and thus stamp some of the members with all the appearance of creatures indigenous to the country. Notwithstanding this, however, there are a variety of circumstances which seem to point to the place of origin as somewhere in the mountainous districts of Western Asia. This seems to be specially shown in the fact that the sheep existing in that region display in the structural variations found in the individual fibres which compose the fleece, all the variations which are found separately existing in those of the various kinds of sheep in other parts of the world.

The natural division in the zoological scale to which the sheep belongs constitutes the fifth family of the natural order *Ruminantia*. This family is called the Bovidæ, from the Latin *Bovis*, an ox, because it includes within it the various species of animals which we usually term cattle, and also the antelopes, besides goats and sheep.

The goats and sheep form the second group of this family, and although distinct species, they are closely allied, but easily distinguished from each other by their appearance, as well as by their structural differences. Both the sheep and goats are furnished with horns, which are compressed, usually angulated, rugose, turned more or less backward, and sometimes twisted into a close spiral. Except in some of the domesticated varieties, both sexes are furnished with horns, but those of the female are much smaller than the male, whose horns sometimes reach very large dimensions. Both sheep and goats are essentially gregarious. The goats, as a rule, prefer the highest ground, and are more hardy than the sheep, while the latter usually prefer to remain in the richer pastures in the bottom of the valleys, or on the plains at the base of the mountain. The goats (*Capridæ*) are distinguished from the sheep by having the horns simply re-curved, and by the total absence of lachrymal sinuses and glands between the hoofs. All the males are furnished with a beard beneath the chin. The characteristic habits of the goat are the same all over the world.

Although goats are wool-bearing animals in one sense of the term, they are not so in the highest sense—that is, the fibrous covering can never attain those peculiar qualities which are distinctive of wool in its highest state of perfection—the development seems to be arrested at a certain stage beyond which it never passes. The external covering of the goat consists of long hair, which differs in thickness and length in different parts of the body, and which varies in quality and fineness in different species and at different periods of the year. The coat is thick and solid, and consists of two different classes of hair—the outer growth, which is true hair, being much longer and thicker, while the undergrowth consists of a kind of woolly hair, which has a greater tendency to curl and mat together. Like the sheep, in the goat the quality of the hair can be greatly improved by breeding and cultivation, and can be made to grow long, fine and silky, until it forms a beautiful material for textile fabrics. It never, however, changes its peculiar characteristics, and no cultivation can prevent the growth of the outer hair as in the case of the sheep, or change the fine woolly hair into true wool. Intermediate between the goat and the sheep is the Aoudad (*Ammotragus tragelaphus*), a remarkable sheep-like creature found in the mountain ranges of North Africa. Like the goat, it possesses no lachrymal sinuses, but it has, in common with the sheep, a gland between the hoofs. The character of the fleece is also intermediate, for true wool is mingled with the more goat-like hair.

The true sheep (*Ovidæ*) are distinguished structurally from the goats by the possession of both lachrymal sinuses and of glands between the hoofs which produce a fatty secretion. The horns are also unlike the goat, frequently twisted into a spiral, while the beard, which is so conspicuous in the goat, is wanting in the sheep. The general form of the sheep is fuller, rounder, and less angular than that of the goat, and the nostrils are lengthened and terminate without a muzzle.

The fibrous covering of the body is usually shorter than that of the goat, and, while in the wild state the fleece is mixed with hair, it is always in major part composed of true wool, which may, however, be coarse in character, but is always in such cases accompanied by an undergrowth of finer wool. Unlike the goat, by cultivation and domestication in the sheep this hair can be entirely removed or bred out, and the whole covering of the skin made to consist of true wool only.

The hair or wool of the domestic sheep (*Aries ovis*) has a distinct individuality of its own when in its highest state of development, but the tendency to run into varieties, which is so marked a characteristic in this class of animals, is also true of the fibrous covering. Purity of breed and cultivation tend to check variation in every direction, and the greatest uniformity in the likeness of individual fibres is always found in the most cultivated sheep. Here the departure from true hair as distinguished from true wool is most marked.

A classification of wools may, indeed, be based upon the degree of variation from the structure of hair which will embrace all the varieties of wool which are found either in wild or domestic sheep.

To understand this classification we must notice the difference in structure between hair and wool in their greatest divergence.

Both hairs and wool are true appendages of the skin, being outgrowths of the epidermis. They differ from each other little in general structure, and the method of generation is the same. When attached to the animal, each fibre is implanted in a cutaneous depression or follicle, which is an involution of the epidermis, and corresponds with the epidermis in structure layer by layer. The hair is fixed into this follicle and attached to the bottom by a dilation called the bulb or knob of the hair, which encloses the papilla or pulp from which the hair is generated. In structure the hair is built up of a series of cells which undergo modification so as to constitute the different parts during the process of growth. Thus, the hair is in living connection with the fibrous sheath of the follicle. The hair itself forms a long more or less cylindrical body, part of which is imbedded within the follicle, but the larger part is external to it and outside the skin. This portion is termed the shaft or stem of the hair, and it usually decreases in diameter from the base towards the unattached extremity, where, when uncut, it terminates in a point of more or less fineness.

In cross-section the fibre usually consists of three parts:—

1. A central core or pith usually containing larger cells. In many hairs and wools, however, this portion is frequently absent.

2. A cortical substance, which constitutes the major part of the shaft, built up of firm, elastic, spindle-shaped cells, surrounding the core when this is present, and extending to the circumference within a very few layers. Upon this cortical substance depends the strength, elasticity, and quality of the fibre.

3. An outer sheath, or coating, or cuticle, which covers the surface of the hair, and which consists of a series of flattened cells which form a coating of fine imbricated scales, the free margins of which are always in the direction of the growth that is towards the point of the hair.

The difference in structure between wool and hair is very difficult to define scientifically, for although in practice the difference is well-known by experts, it depends upon such slight modifications that it is very difficult to determine where the distinction lies. The difference indeed is rather one of *degree* than *kind*, and they shade into each other in such a way that the fine hair in many of the goats is very like wool, and the coarse wool in many sheep very like hair.

The true difference does not consist, as many suppose, in the fact that the wool has a curved or curled appearance, whereas the hair is straight, because there are many exceptions to this rule. The curled locks of the negro are true hair and not wool, and in many animals where the structure of the fibre is that of true wool, the curl is entirely absent.

The true difference consists in the method of attachment of the epidermal scales which form the outer sheath or covering of the fibre.

In true hair the scales are firmly attached to the cortical part of the shaft throughout the greater part of their length, and only reveal themselves when the fibre is examined through the microscope as faintly anastomosing lines on the surface. The scales may differ in size in proportion to the diameter of the hair, and vary in the configuration of the free margins, but they are generally more or less rounded at the edge, and never present the appearance of a serration when viewed with transmitted light. The scales in hair are also more horny and dense in structure than in wool, and frequently thicker and less plate-like. The structure of different hairs, however, vary much in these respects. Sometimes the scales are very regular, and give the appearance of the stem of a palm tree, the scales overlapping each other like the plates on the scaly back of a fish, or tiles on a house top.

Intermediate between true hairs and true wool we have a structure which, to a certain extent, may be taken as typical of the transition from one to the other. This structure is found in the hair of the Alpaca goat (*Auchenia Paco*), which is however a species of camel, and in that of the Angora goat (*Capra hircus Angorensis*) which furnishes the Mohair.

In these fibres the epidermal scales are larger and more distinct than in the hair, and form a series of more or less irregular horny plates, the free margins of which are more loosely attached than in the case of true hair. When carefully compared with the scales on the surface of true wool, the Alpaca scales are more robust and dense, and wanting in translucency, having a sort of ivory consistency rather than a glassy appearance. As a rule also, we may assume that the structure of the Alpaca fibre is denser than that of wool, and offers a greater resistance to the penetration of dyes, more especially those which require the aid of a mordant to fix them.

This fibre may be taken to represent generally the character of the fibres of goats' hair, and the coarser portions of the fleece of the semi-wild sheep of Central Asia. All these fibres possess a high lustre, because the scales are large and covered with a brilliant enamel which reflects the light in sheets to the eye. Coloured fibres possess this lustre in a less degree.

When the long-woolled sheep are reached, we have the fibres assuming

the form and character of true wool. The scales on the surface become more numerous, and the attachment of the free margins less. The edges of the scales become more serrated, and their structure more gelatinous and transparent and less horny. As a rule, they assume also a more ring-like form, the whole diameter of the fibre being crossed by a single scale. The edge of the fibre also, when examined by transmitted light, shows a distinct serration. In these wools we seldom find the fibres show any trace of a central pith. The whole hair substance being formed like the cortical part, and the fibres are thus rendered softer and more pliable, while the elasticity is unimpaired. The free margins are also more irregular and less rounded at the edge, and stand out from the surface of the fibre; and it will be easily seen, how, when two fibres of this wool are opposed to each other, so that the edges of the scales in the one come in contact with those of the other, a felting action, which is so characteristic of true wool, ensues, by the interlocking of the respective scales into each other.

In the Merino, and its crosses with other breeds of sheep, we find all the qualities of wool reach their highest state of perfection. The fibre itself becomes more transparent and soft, the scales become more delicate and numerous, and the irregularity in the free margins more distinct. The curved or curled nature of the fibre also causes these scales to stand out more from the surface, quite independently of the fact that they are less firmly attached to the cortical part. The serrated edge of the fibre is everywhere distinctly seen.

In these fine wools every one of the best attributes of wool are seen in their highest degree of perfection.*

Of course it must be understood that between each of these four types there is an almost infinite number of shades and degrees which are further complicated by the variations which are found in the internal structure of the fibres. These may however be taken as generally representative of the classes which have been named. It will be noticed by those who are practically acquainted with the growth and use of wools, how closely this classification, based upon the characteristics of the individual fibres, corresponds to the divisions which are ordinarily made in agriculture and commerce. These divisions may be stated as follows:—

1. The bright-haired fibres, of which Alpaca and Mohair may be taken as the type.
2. The deep-grown lustrous wools, such as Lincoln, Yorkshire, Leicester, pure Lincoln and Leicester Botany, Cotswolds, &c.
3. The half-bred wools, such as crosses with the sheep named in the last class along with Southdowns or Merinos.
4. The soft fine clothing wools, such as the Southdowns, Merinos and their allies.

In treating of the wools shown in the Exhibition, it might have been desirable and certainly more scientific to treat them generally under some such divisions as those now mentioned, in order that a comparison of the relative merits of the various wools exhibited in the different Courts might be made. This would however have necessitated those who wished for

* Those who wish for full information on this subject are referred to "The Structure of the Wool Fibre" (Simpkin, Marshall & Co., London; and Palmer & Howe, Manchester), by the author of this report, where illustrations of the different fibres will also be found.

information on the wools of any special Colony to go through the whole report in order to obtain the full advantage, and it seems therefore better to take each Colony seriatim, and reserve all general considerations until the end. In following this plan, all the Exhibits have been given their number after the name. This is the number which was found either in the General Catalogue or by preference in the Special Catalogue issued by each department. This is done so as to enable reference to be made direct, as many of the Catalogues were most complete in giving the character and age of the sheep, the district and food upon which it was fed, &c., which was most valuable in making comparative examinations. In taking the individual Colonies as the basis of classification, the same order of sequence has been observed as in the Official Catalogue.

Although, strictly speaking, a notice on the wools of India does not come within the scope of this report, which is really confined to the Colonial Sections of the Exhibition, it is impossible to pass that Empire without a word, because of the importance of the small exhibit from a historical and scientific point of view.

INDIA.

The whole of the wools exhibited from India, except one or two incidental specimens, were confined to those contained in a case within the Economic Court. In speaking of them as wools, the term is used in its widest sense, so as to include all goat and sheep fibres. The samples were twenty-three in number, and no reference appears to be made to them specially in the Official Catalogue. Few of these samples were named specifically, the largest portion being only distinguished by a number or letter without label. In character they covered a wide range of quality from the very coarsest goats' hair down to the finest wool or pure *pashmina*, which is the undergrowth of the Thibetan shawl-goat, as well as the native Indian wools, of which there are at least eight varieties. These wools are interesting, as they contain almost every variation in the individual fibres which is to be found in all other races of sheep. Most of the hairs and wools exhibited in this section, however, are of comparatively small interest to European manufacturers, because the export is small and the quality such that they can only be used for the coarsest class of goods, and when worked by machinery they require to be mixed with other wools. They are however of considerable importance in India, as forming the staple of the woollen industry in the mountainous districts where the great bulk of the woollen goods are worn. Many of them are singular mixtures of coarse and fine fibres, so much so that those who are only accustomed to the regular wools of cultivated sheep can hardly conceive it possible that many of the samples could be obtained from a single animal. The finest specimens in quality and regularity of fibre, and in all characteristics which are typical of the best wools, can scarcely be surpassed; but by far the largest number of samples are defaced by irregularities in the structure and quality of fibre which are only to be found in the most neglected sheep of the United Kingdom and the Colonies. To enumerate all the defects which are found in many of these wools when compared with the highest

standards attainable in the Australasian Colonies, would be to mention all the defects to be found in any wools, and indeed many of the samples probably resemble the covering of the primitive sheep from which all the truly domestic varieties are originally derived. Without further knowledge in regard to the place of origin, a mere classification of these wools would be of little service, and especially since the wools of India scarcely come within the scope of this report, and will probably receive attention elsewhere.

CANADA.

Although the general display of products from Canada was, as might be expected from the size and importance of the Dominion, the largest in the Exhibition, it is singular that up to the end of August there was not a single example of raw wool. The woollen manufactures of Canada were largely represented, and the exhibits were of excellent quality in every respect; but the large sheep-rearing industry was totally unrepresented, except by tinned mutton. A few fleeces were afterwards received from Manitoba, and two samples supplied to be reported upon.

No. 1, from Charles Geekie, Strathclan, was a fair specimen of Leicester wether, with medium quality in fineness and length of staple, but with less lustre than usual in English wool of this character.

No. 2, from Mrs. Meickle, Clandeboye, was taken from a south-down shirling, and was of medium quality also. The regularity in the length was good, but the staple was only of average quality, and not so fine in the fibre as usually seen in this class of sheep.

Notwithstanding this paucity of exhibit, there are very large numbers of sheep of almost every variety to be found in the various provinces of the Dominion. The last return supplied by the Department in September, 1886, placed the number at about 4,050,000. Hitherto the largest number of sheep appear to be confined to the English long-woolled class, such as Lincoln, Old and New Leicester, Cotswold and Cotswold Leicesters, Cheviots and Shropshire and other Down short-woolled sheep. Vermont merinos appear to have been introduced, and the prevailing requirement for woollen manufacturers being at present in the direction of merino wool and its derivatives, this will no doubt increase the number of merinos, and solve the problem whether the climate, &c., of Canada in some of its provinces is as well suited for the growth of fine as it has proved to be for that of the deep-grown wools.

NEW SOUTH WALES.

The moment the visitor entered the Courts of any of the Australian Colonies the eye was attracted by the magnificent display of wools which abounded on every hand, and formed one of the most attractive features of

the Exhibition. If a gilded trophy had been erected to bring home to the imagination the enormous sums of money which the various Colonies have received since their foundation for the wool which they have sent to Europe, the vast pyramid or arch would have far exceeded in dimensions the trophies which record the amount of gold obtained from the diggings and mines. As the oldest of the Australian Colonies, New South Wales might naturally be expected to send a first-class exhibit of wool, since the merino sheep was introduced there in the early part of the present century by Captain Macarthur, and thus laid the foundation of the future prosperity of the settlement. Since that time the flocks have been improved by the importation of sheep from the choicest breeds of France, Spain, and Germany. The number of sheep in this Colony, in the two decades from 1860 to 1880, increased in a greater ratio than in any of the other Australian Colonies, the increase amounting to, as has been computed, about 628 per cent. The export of wool in 1884 reached the enormous quantity of 173,986,303 lbs.

The samples of wool exhibited in this Court were well arranged for inspection in two series of long flat glass-covered cases down the centre of the Court, and in a set of upright cases at one side. Each of these cases was divided into a series of compartments which opened separately. The name of the owner of the exhibit and the designation of the station where the wool was grown was painted on the face of the case. All the samples exhibited in this Court, with the exception of about four in number, were unwashed. The total number of exhibits, including Mohair, was seventy-eight, but the number of exhibitors was only thirty-seven. As might have been expected, the largest number of samples were from the various breeds of merino sheep, and included almost every grade from the finest short to the longest stapled combing wools. One of the great difficulties experienced in reporting on the wools in all the sections of the Colonial exhibits is the high standard of excellence which was everywhere maintained. No doubt, in selecting the samples for exhibition, care was exercised to prevent any fleeces which contained marked defects from being placed there, and hence comparison of the different samples shown requires great care to prevent the remarks upon special cases being considered as invidious distinctions. It must therefore be understood that in cases where no mention is made of individual exhibits, it is not because these were inferior in quality, but because space forbids a detailed examination of every individual specimen.

In this section of the Exhibition a very high standard was maintained throughout, and, with few exceptions, the wools shown were of the respective classes in the very first rank of perfection so far as sheep culture has hitherto attained. The long merino combing wools from this Colony were specially noticeable, and showed the advance which has been made within recent years, as New South Wales has hitherto been specially famous for the fine clothing wools which occupy a first-class position in the market, and show unmistakably the best qualities of the Silesian strain which has had such a marked effect in this Colony. They do not, however, as a rule, possess the same high lustre as Victorian, but are finer in character.

Some of the Exhibition cases were so arranged that it was impossible to obtain samples for detailed examination, and therefore in these instances report cannot be made, except by stating that, so far as judgment can

be pronounced without further examination than the eye affords, they all seemed to be very good specimens of merino wool.

Chisholm Bros. (Nos. 144 and 145). Six fleeces each of fine combing rams' and ewes' wool. These were very good examples of the improvement in staple of the Silesian rams from which they were descended.

The Collaroy Co., Limited (Nos. 146 to 151), made a good display of pure Australian merino, both carding and combing. Some of the samples were very fine in quality, and show the excellence of the Collaroy breed.

Macdonald Bros. (Nos. 156 and 157), Mrs. S. Darchy (No. 158), and Cuthbert Featherstonhaugh (No. 161) showed first-class samples of combing wool.

Gibson and Co. (Nos. 162 to 165) and David Hannah (Nos. 168 and 169) displayed very good regular wool from the ordinary station flocks.

Thos. W. Hammond (Nos. 166 and 167) exhibited fine combing merino, which was sound useful wool.

Bernard Haydon (No. 170), G. R. Higgins (Nos. 171 and 172), and F. W. Hume (Nos. 173 and 174) showed excellent samples of fine merino combing.

C. H. James and Gray (Nos. 175 to 177) presented some splendid specimens of combing wools, both scoured and unscoured.

George Genkins (Nos. 178 and 179) exhibited splendid specimens of fine merino combing. The fibre in some of the fleeces was very fine and pure.

James Lee (Nos. 180 and 181) and J. M. L. Macdonald (Nos. 182 and 183) showed first-class examples of combing wools.

The Hon. G. H. Cox (Nos. 153 to 155) and J. C. Manchee (Nos. 185 to 189) made good exhibits of combing and other wools; but the cases were closed, and no samples could be obtained from them.

G. J. Mulholland (Nos. 190 to 192) showed good samples of fine combing; one of these specimens was very good.

Mrs. Arthur A. W. Onslow (Nos. 194 and 195) exhibited some splendid samples of merino. These had an additional interest, as being from descendants of the original merinos imported by Captain MacArthur in 1797, which were the first introduced into Australia. One of the samples was an almost perfect specimen of merino wool.

Ormond and Brook Bros. (No. 195) exhibited a most beautiful example of merino ewe's wool.

The Peel River Land and Mineral Co. (Nos. 196 to 198) made an excellent show of long and short merino wool which was of excellent quality.

The same may also be said of the exhibits of Joseph Penzer (No. 199), R. G. A. Robertson (Nos. 200 and 201), and Alexander Sloane (Nos. 202 to 204). The latter had some samples which left little to be desired in all the qualities which are best in wool.

F. B. Suttor (Nos. 207 to 209), H. Walker (Nos. 212 and 213), H. C. White (Nos. 214 and 215), and the Hon. William Wilson (No. 218); all showed good examples of first-class wool in every respect.

No samples were obtained, in consequence of the cases being fastened, from R. C. Cooper (No. 152), P. McGreer (No. 184), John L. Suckling (Nos. 205 and 206), Tobin and Sons (No. 210), Traill Bros. (No. 211),

and J. F. and H. White (No. 217); but all seemed good wool of their respective kinds, judging by appearance alone.

The only specimens of long English wools exhibited in this Court were shown by E. Woodhouse (Nos. 219 and 220); combing wools from Romney Marsh sheep. These wools were good free-grown fleeces, sound and strong, but the fibres were not so lustrous as in the English-grown wools of the same type.

John Black (No. 143) exhibited very good samples of mohair, from common goats, crossed with imported Angoras. The fibre was first-class—fine, long, and silky—and most interesting as indicating a great future for this industry.

Altogether the collection in this Court was of a very high class, and clearly indicated that in everything which constitutes success in sheep-farming, New South Wales has nothing to fear in competition with the other Australian Colonies.

VICTORIA.

There was a splendid exhibit of wool in this Court. The samples were very well and tastefully arranged in a series of cases. Some were of the ordinary museum form, and others upright against the sides of the Court. In each compartment of these cases a ticket was placed giving the name and address of the exhibitor and nature of the exhibit. In some of the cases where there were several different qualities of wool, some of the cards had been mixed in transit, which rendered it difficult to distinguish them with perfect accuracy by means of the description given in the Official Catalogue. Considerable interest was added to the collection by the exhibition of heads of merino and other rams on the fittings of the cases, and photographs of the sheep from which some of the samples were obtained. The Colony of Victoria has long been celebrated for the high-class character of its wools, which are distinguished by their fineness, length of staple, softness, and lustre, and have maintained a foremost place in the markets of Europe. In this respect the exhibit in this Court occupied the first place in the Exhibition. By far the largest portion of the exhibit was confined to the merino, both in combing and carding qualities, but in the Colony flocks of English lustre long-woolled sheep are also found—principally Lincolns—which flourish in the moist heavily-grassed districts on the southern coast. As in the case of all the Colonial exhibits, it was extremely difficult to apportion merit to the different samples, because all were of such a high character of their respective kinds that they seemed to leave little to desire, possessing all the characteristics which are best in wool. In merino wool there were forty-four examples shown by fourteen exhibitors, exclusive of the magnificent collection termed a "special exhibit" by R. Goldsborough and Co., Limited, which included sixteen exhibits, and that of the Australian Mortgage and Land Agency Company, Limited, which had samples from eighteen growers.

Bailey and Wynne showed samples of first-class merino. One sample

of pure merino of the "Sir Thomas strain" deserves special mention for its excellence.

The Hon. Phillip Russell exhibited a very fine collection, including that comprised in the Special Exhibit. These wools were of the highest class, and show the high quality of the Carngham flocks both in lustre and softness.

Thomas Russell and Robert Simpson showed good useful wool, also with high lustre and softness.

T. Russell and Co.'s exhibit was of very good quality.

Lieut.-Col. Buchanan exhibited samples of pure merino of the highest quality; some of the samples were very fine in the staple.

The owners of the South Brighton Estate—W. H. Bullivant, W. and N. G. Elder, Charles Ayrey, and W. Lewis, all presented very fine samples of merino. They differed from each other in special points, but were all of very first-rate quality.

John Wilson, J. L. Currie and Co., and Joseph Ware exhibited some splendid wools.

Sir W. J. Clarke had very good samples of long combing wools.

Taken as a whole, it would be impossible to exceed the standard of the Special Exhibit by Messrs. R. Goldsborough and Co., which showed the high state of perfection which wool-farming has reached in this Colony.

Special mention must be made of the wools exhibited by Sir Samuel Wilson, the character of which left nothing to be desired in their respective classes. The samples were almost the perfection of wool, and for practical purposes nothing better need be required.

Walter Williamson, Molesworth and Matheson, and George Carmichael had all first-class specimens of merino wool; while it would be difficult to say whether C. and J. Degraves, G. W. Thomson, or Charles Percy Davis exhibited the highest standard, the quality being so uniformly good.

Chrystal Le Fevre and Co., Thomas Dowling and Son, and E. Byam Wight, Jun., showed very fine specimens of pure merinos which were of the highest class.

It is almost impossible to speak too highly of some of these exhibits, and they deserve the highest commendation in every respect, specially those which were shown by Sir Samuel Wilson, the Hon. P. Russell, John Wilson, J. L. Currie and Co., Joseph Ware, and Thos. Dowling and Son.

J. H. Halliburton and Co. exhibited scoured wool of fine merino quality.

The United Shire of Metcalf sent some very fine merino wools. One specimen from the estate of Henry De Little was very beautiful.

A very fine collection of wool was also exhibited by the Australian Mortgage and Land Agency Co., in which were included samples of many of the wools already noticed. This exhibit comprised both carding and combing wools, and all were of the highest class of their respective kinds. Besides names already mentioned, these wools were grown by the Hon. J. Balfour, H. and C. Douglas, J. Kinnanmouth, P. McIntyre, E. Morley, C. Martin, Hon. F. Ormond, J. M. Sanger, T. Shaw, and the Hon. Robert Simson. The sample of the latter was particularly fine.

In all the exhibits in this Colony the high lustre and softness which is so much prized for worsted dress-goods and coatings was particularly notice-

able, and if the samples shown are a fair average of the general character of the wools grown, Victoria may well be proud of the magnificent breed of sheep it possesses, and of the soil and climate which can produce such results. In 1882 the yield of wool was 52,223,000 lbs.

SOUTH AUSTRALIA.

The exhibit of wool and its allies in this section was the most effective in the Exhibition. In addition to the tasteful manner in which the cases were got up and arranged, the visitor was specially struck by the beautiful specimens of goats, camels, and sheep, which were stuffed in their natural condition as seen in the pastures, and placed in pens on natural turf. The beautiful stud merino sheep brought home to the mind the wonderful improvement produced by breed and climate on the original merino, especially in the size of the animal, which could be well compared with the Australian Lincoln sheep exhibited in another pen. To exhibit these was a most happy idea, and exceedingly well carried out.

The cases containing the wools covered a large area, and were of the usual museum type with compartments for each exhibit. Each compartment of the case was marked by a shield, with the arms of Australia and the name of the exhibitor at the top. The name of the station being marked on the front of the case. In addition to this, at each end of the line of cases a small, flat, upright case, was attached to the top of the case, and in this was exhibited a small sample of each wool, to show the length of the staple, the samples being each tied up with blue ribbon, which was very effective. Some of the staples of merino wether fleeces were 3½ to 4½ inches long, and hogg's 5 inches, with magnificent fineness of fibre.

The number of exhibitors in this section was twenty-one, but each sent many samples of different kinds and ages of wool, which were most instructive.

The whole exhibit in this section was first-class in every respect; so much so that a careful examination of the various wools rendered it almost impossible to make any invidious distinction, except in point of size of exhibit. Most of the wools were of the very highest state of perfection, and though some lacked the lustre and fineness of some of the Victorian wools, or the distinguishing softness and pliability of the New South Wales wools, still in many cases nothing could exceed the beauty of the samples. The character of these wools has advanced amazingly within the last few years; and if sufficient care is observed in the classification and condition of the wool, they will command a foremost place in the markets of the world.

John Riddock (No. 14) exhibited a pure merino ram and ewe stuffed, the wool of which was most beautiful, and in addition a large collection of wool of the highest quality and breed.

John Rounsevell (No. 16) showed a pure-bred merino ram stuffed, and a collection of splendid wool.

John Murray (No. 12) exhibited a pure-bred merino ram, ewe and lamb

stuffed, the wool of which left nothing to be desired; and the exhibit of wool in the case was of the very highest class in every respect.

The Hon. A. B. Murray (No. 11) showed a stuffed merino ewe, and an exhibit in a case, all of first-class excellence.

James, Sanders and Co. made a splendid show with a stuffed pure merino ram of very large size, equal to a Lincoln sheep; but the wool, although of first-class quality, was not so white or fine as that exhibited by John Riddock. The staple both on this ram and in the museum case of most of the wool was exceptionally long. Altogether the wool exhibited by this firm was excellent.

J. H. Angas (No. 1) showed a pure-bred stuffed merino ram, ewe and lamb, the wool of which were of the highest class; also two Lincoln rams stuffed, with first-class wool. The lustre on these rams was splendid, equal to that of the best English sheep. The combing merino wools shown by this gentleman were very good indeed.

James Anderson (No. 2). The wool exhibited was very good; strong useful staple.

Edmund Bowman (No. 3) and E. and C. W. Bowman (No. 4) showed most excellent clips. In both cases some of the wool left nothing to be desired.

J. D. Bruce (No. 5) and William Crozier (No. 6). All first-class wools.

Sir Thomas Elder (No. 7). This exhibit deserves special notice, not only on account of its excellence, but also because of the extent of territory over which the wool was grown. All these wools were of first-class quality in every respect.

The Hon. G. C. Hawker, M.P. (No. 8), exhibited some splendid wool. Some of the specimens were very beautiful, and possessed many of the qualities most desirable in wool.

Hogarth and Warren (No. 9) also showed some excellent wool.

R. R. Keynes (No. 10) and John Robertson (No. 15). Both presented first-class specimens of merino wool.

E. Salter (No. 17) and B. Sepplet (No. 19) exhibited some excellent wool.

E. C. and J. Stirling (No. 21) was a first-class exhibit. Some of the merino rams', ewes' and lambs' wool was specially deserving of notice.

Smith and Swan (No. 20) and Duffield and Makin showed first-class merino wool.

Maurice Price (No. 13) exhibited a group of stuffed Angora goats, the hair of which was of first-class lustre.

All the mohair exhibited in the Australian Courts has, however, a distinctive character of its own. The fibres are fine, but the structure of the scales on the surface of the fibres tends in the direction of wool—that is, the scales are looser in character than the Turkish or Cape mohair, and this produces a softer feel, but less lustre.

John Reid and Sons (No. 25) exhibited a number of good wool mats, which had been dyed various colours by F. H. Schlork and Co., who also showed samples of wool dyed in a variety of colours.

QUEENSLAND.

The wools in this section of the Exhibition were exhibited in two long glass cases which stood down the centre of one of the Courts. The cases were tall, with sides sloping at a small angle, so that the wool could be easily examined. Each fleece occupied a separate compartment, and a card gave the name and address of the exhibitor. The wools included samples of heavy and fine combing, merino, cross-bred and coarse wools; but owing to the severe drought which had prevailed in the Colony during the former year, the exhibition of wools was not so complete as would otherwise have been the case. The exhibit was, however, generally a very good one, and although many of the wools could not vie in lustre and softness with some of the splendid wools sent from Victoria or South Australia, they were, on the whole, very good, and some of exceptional beauty. The coarse-woolled samples were principally crosses with the Lincoln and Merino, but crosses with Leicesters, Cotswolds, and Downs were also represented, some of the latter being specially fine. With care and attention to purity of breed, these wools will, undoubtedly, in a few years command a first-class position in the markets of the world, and very great advances have evidently been made within the last half-decade. The production of wool in this Colony is very large, the last return giving 42,472,000 lbs.

William Allan (No. 298). This was a very good exhibit of merino combing wool, but the principal and most interesting feature was the pure black merino from a special strain in the possession of the exhibitor. This wool possessed all the characteristics of the best white merino, except being of a dark-brown colour, and as this is unmixed with white, it possesses a special value for certain classes of manufacture, as it can be used for fast-coloured goods without dyeing.

C. A. Armitage (No. 299), Clarnside Riley and Co. (No. 300), and George Clarke (No. 301). All showed some first-class combing merino wool. The exhibit of the latter deserves special mention.

The Darling Downs and Western Land Co. (No. 202), the Queensland Co-operative Pastoral Co. (No. 311), the Western Queensland Pastoral Co. (No. 314), and the Queensland Land and Pastoral Association (No. 312) showed excellent examples of strong, medium, and fine combing wool. Some of the fine clothing wool of the Co-operative Co. was specially good, and seemed exactly suited for the requirements of broad-cloth manufacturers.

C. B. Fisher (No. 304) had good specimens of strong combing, and F. Struver (No. 310) showed some first-class combing, some of the staple of which was 13 inches in length.

Gore and Co. (No. 305), Hodgson and Ramsay (No. 306), and Shanahan and Jennings (No. 309) exhibited very good specimens of fine combing and fine clothing wools. Some of these were of very great excellence.

Fanning, Nankivell and Co. (No. 303), John D. Macaush (No. 307), and Marshall and Slade (No. 308) showed fine combing and clothing wools. Some of the specimens of Marshall and Slade's and Macaush's were specially worthy of notice.

F. J. West (No. 313) and Edward Wineholt (No. 315) also exhibited some good wools of strong and medium combing. These were sound and useful wools.

WESTERN AUSTRALIA.

The wool in this section of the Exhibition was exhibited in two upright cases in the two corners of one of the Courts. The fleeces were each in separate compartments for each exhibitor, and were marked with the name and address, but few particulars were given. The samples were mostly from the South-West districts around Perth, almost all of pure or cross-bred merino wool; and one exhibitor also showed mohair, which indicates the introduction of the Angora goat into this section of Australia.

J. H. Monger (No. 187) showed samples of fine combing merino. This was a really first-class wool.

Norris Taylor (No. 189) exhibited good specimens of cross-bred merino.

James Fleay (No. 190). Samples of combing merino. Good useful wool.

W. Marwick (No. 191) showed good samples of cross-bred merino.

J. and H. Sewell (Nos. 192 and 193) exhibited specimens of cross-bred merino, washed and unwashed. This was fine, free-grown wool.

C. Loyd (No. 194) and B. D. Clarkson (No. 194 A) exhibited cross-bred merino. Both these wools were good of their class, specially the latter.

A. Dempster (No. 195) and C. E. Dempster (No. 196). Both showed specimens of cross-bred merino: the former was strong, useful wool; and the latter, also good.

G. and W. Lefroy (No. 197) and P. Garrity and Sons (No. 198) exhibited samples of cross-bred merino. The wool in both cases was not very fine, but strong and useful.

A. and A. Hassel (Nos. 199 to 200 A) showed samples of cross-bred merino and lambs' wool. This wool was of a good type, but not very fine.

J. Clinch (Nos. 201 to 203) exhibited samples of good, useful combing merino; also Angora fleeces. This mohair was only of a coarse type, and had not the lustre which characterises the best qualities.

W. T. Loton (No. 203 A) showed some heavy fleeces, but the wool was not of very fine quality.

Lacy Bros. (No. 203 B) exhibited samples of pure-bred merino ram and ewe's wool. These wools were very good indeed, and possessed all the qualities of first-class merino. The quality of many of these wools was the best exhibited in this section. They were grown in the Murchison river district.

The wools of this section, with the exception of some of the specimens in the latter exhibit, have not the high character of those shown by the older Colonies; but there is every indication that both climate and herbage are fitted for the highest class of sheep-farming, and the character of some of the wools exhibited by Lacy Bros. approach closely in quality to those from South Wales and South Australia, but lack the peculiar brightness of the Victorian wool. Judging from these samples, the wools of this Colony will probably in time have a distinctive character of their own, and command a high value in the market. In 1885 there were 1,702,719 sheep in the Colony, and about 5,970,000 lbs. of wool was exported.

NEW ZEALAND.

The wools exhibited in this section were exceedingly well arranged, the classification being the best and most scientific in the whole Exhibition. Instead of being arranged as in the other sections, under the head of name and station, all the wools were classified according to character and quality, with the names attached. They were tastefully exhibited in two flat museum cases, each of which was surrounded on three sides with upright cases—the whole exhibit forming a distinct Court to itself. The cases were all divided into separate compartments, with tickets denoting the name and address of the exhibitors—in some cases, with further particulars. While speaking of classification, it is well to point out the great necessity for care in the classification of the wools in packing, specially the half-breds, so as to secure uniformity of quality in the individual lots or bales. Want of attention in this respect is very common, and often seriously detracts from the commercial value of the wool, and is thus a loss to the grower. Nothing adds to the value of wool more than uniformity of character, and in a country where the range of character and quality is so great, this matter needs special attention.

The show of wool was in every respect first-class, and a wider range of kinds of wool was to be found here than in any other Court. The qualities ranged from the very finest merino, both carding and combing, through the Downs to the splendid long-woolled types of Lincoln, Leicester, Romney Marsh and Cotswold.

Here also were represented the half-breds between each of these long-woolled sheeps and the merino, and the crosses back to the merino, so that the peculiar characteristics of these various wools in their intermixture with pure-bred merinos was splendidly shown. The character of the wool obtained by transplanting the pure long-woolled English sheep to the southern hemisphere, and the degree of persistency with which the type remained stamped in the samples exhibited, was most instructive, and clearly demonstrated that if ever there should be a much wider demand for long, strong, lustrous wools than English farmers can supply, that the climate and all the characteristics of New Zealand enable it to supply them in unlimited quantity and of quality which can hardly be surpassed. As in the case of all the other sections of the Exhibition, the fact that all the specimens exhibited were specially selected, rendered it almost impossible to exceed the high standard everywhere attained. In this section samples were only supplied for examination from each class, and not, as in other cases, from each exhibit, and hence individual exhibits cannot be commented on.

The number of exhibitors in the merino class was seventeen. Taken one with another, they presented all the very best qualities which this class of wool has in such large degree. Careful examination presented the fact that these New Zealand merinos had generally characteristics of their own, in which they differed from the other Colonial wools. They had not, in all cases, the lustre and exceeding softness of some of the Victorian wools, or the fineness of staple in some of the samples from New South Wales; but they possessed firm, free, well-grown fibres, with great regularity in length and in the epidermal structure, and were magnificent wools for manufacturing purposes.

The long combing merinos were shown by fourteen exhibitors, and were most excellent wools of their class. Some of the specimens were not exceeded in the whole Exhibition.

The Down wools presented samples of the pure Down, Hampshire Down and Shropshire Down, and in each of these cases, the very best characteristics of the original stock were preserved and perpetuated.

In the long-woolled breeds, there was a most magnificent show, no less than twenty-eight exhibitors sending samples, of which sixteen were Lincoln; two, Leicester; three, Border Leicester; six, Romney Marsh; and one, Cotswold.

Some of the Lincoln specimens were magnificent. The strong bold fibre, with high lustre and length, and heavy locks, showing how well all that was best in this wool was maintained; but taken as a whole, the lustre was scarcely up to the high standard in the purest English-grown wool of this class.

One of the samples of Leicester was equal to the very best English wool, and the Border Leicesters were equally good.

The Romney Marsh wool had all the loftiness which usually characterises the fibre of this fine sheep; and from the splendid examples shown, it seems as if the climate and soil of New Zealand was peculiarly fitted for its growth.

The Cotswold was also very good.

In half-bred wools, eight exhibits were presented, those shown by W. E. Ivey, Director of the School of Agriculture, being specially worthy of notice. As might be expected where the pure breeds are so perfect, the half-breeds of their respective kinds are first-class also.

In cross-breds and crosses back to the merino, there were seventeen exhibits, and, of their respective kinds, they were all excellent. Here, also, some of the samples shown by the Director of the School of Agriculture attracted special attention.

Although, in this section, the exhibitors have not been given seriatim, it has been because all are so excellent in character, that distinctions could scarcely be made, and it is sufficient to say that the whole exhibit was worthy of a Colony, which has reproduced the very best types of English wool, and in some cases, surpassed them, and which must in the future always, if the same care in sheep culture is exercised, take a foremost place among the great wool-producing countries of the world.

The quantity of wool exported from this Colony in 1884 was 81,139,028 lbs.

CAPE OF GOOD HOPE.

There was a large selection of wool exhibited in this section, and the samples were well arranged for inspection in three museum cases. All the exhibits were in separate compartments, and each ticketed with the name and address of the exhibitor.

In addition to the wools, a special feature of this section was the first-class show of mohair and other goat fibres. Also in a separate case, along with some stuffed specimens of ostriches, a number of the stuffed Angora goats were shown, adding considerably to the interest of the Exhibition. The exhibit of mohair was most encouraging, because it clearly demonstrated that the Angora goat, which at one time it was thought impossible to acclimatise beyond its native habitat, has been successfully naturalised in this Colony, with little detriment to the quality of the hair, and with care and attention the quality may be greatly improved. The samples exhibited seem to indicate that, in this great and increasingly important industry, the Colony has a great future before it. The African wools have a destinctive character of their own. They lack the high lustre and exceeding fineness of staple or length of the Australian merinos, but they are sound, useful wools, with, in some intances, great strength of fibre, and well adapted for medium qualities, both in worsted or woollen goods, specially the latter. More care and attention to breed and general culture would, no doubt, improve some of them, and place them in a foremost position where their special qualities could be best utilised; and this will also, no doubt, be facilitated by the selection or improvement of pasturage, which has a wonderful effect on the quality of the wool. The same may be said of the mohair, which is a comparatively new industry, and will be noticed further on.

Amongst the exhibit of wools the first place must be given to that of the Cape Commission (No. 35), which included wools from four districts of the Colony, which lie to the east of Cape Town, and bordering on the South Indian Ocean.

From Bredasdorp Division the examples were of soft clothing wools from Cape-bred sheep, and were of fair quality; one was specially good.

From Caledon Division two samples were also exhibited; these were both of the short, fine, clothing wools, and were of fair quality.

From Riversdale Division similar examples of wool were shown, both scoured and in the grease. These wools were sound, fine quality.

From Swellendam Division also wools of a similar classification were exhibited. One sample deserves special notice—the fibre was very fine and soft.

Along with this exhibit also were samples of wool from the Beaufort Division (West), which lies considerably to the east of the four divisions already mentioned, and more inland, near to King William's Town. These were similar in quality to those samples already named, evidently from Cape-bred sheep, and were fine, useable wools.

The private exhibits of wool in this section of the Exhibition were twenty-nine in number, mostly of the merino type and from Cape-bred sheep.

G. J. N. Booysen (No. 35). Wool of very good quality; the staple of one sample was very fine.

Breda Halleett and Co. (No. 37). Fine-scoured wool of excellent quality.

H. J. De Jager (No. 38) and W. A. Hart (No. 43). Samples of useful clothing and combing wool.

The Despatch Wool-Washing Company (No. 39), Frater and Mossop (No. 41), and W. T. Gubb (No. 42) showed samples of washed wool—in all

cases the washing was well done, and the fibre was very little injured. The wool was of good quality.

T. W. Elliot (No. 40) and J. J. Irvine (No. 44). Both exhibited samples of fine well-grown wool. Both these wools were of very fine quality.

C. Jackson (No. 45), A. H. Jackson (No. 46), and P. J. Joubert (No. 47). All showed very good examples of fine merino. The latter was a specially fine sample.

J. Kemp (No. 48), Geo. King and Sons (No. 49), and Jas. S. Moorcroft (No. 50), exhibited samples of fine clothing merino.

J. O'Connor (No. 53), the Springfield Wool-Washing Company (No. 58), the Union Wool-Washing Company (No. 59), and the Waverley Wool-Washing Company (No. 61). All showed excellent samples of scoured wool in various qualities. In some cases the wool was also shown before scouring.

Geo. B. Murray (No. 51), J. J. Murray (No. 52), Paul. C. Rorich (No. 54), and Peter D. Rose (No. 55), exhibited samples of fine wool. Samples No. 52 and No. 54 deserve special mention.

R. Rubidge (No. 56), and Savage and Hill (No. 57), showed samples of sound useful wool. The exhibit of the latter was very good indeed, and the wools of excellent quality.

J. A. Vermaak (No. 60), Weeber Bros. (No. 62), F. F. Wienand (No. 63), and John Edwards (No. 68), exhibited samples of fine wool. Some of the samples (No. 60) were of excellent quality.

Wilman, Spilhaus and Co. (No. 64) showed a very good set of samples of wools, both in grease and scoured, grown in the western part of the Colony.

Many of these wools were similar to those shown by the Cape Commission, and were all of very good quality of their respective kinds.

The exhibit of mohair in this section was the most complete in the whole Exhibition, and some of the specimens were very creditable, but as a rule the samples were rather too strong in the fibre, and wanting in lustre and length when compared with the best Turkish mohair.

Joseph Edwards (No. 68). This sample was very long and silky, but rather too coarse in the hair for best quality.

Walter James Edwards (No. 69). The sample was long and fine in the hair, but short of lustre.

John Hall (No. 70). No sample obtained.

Frank Holland (No. 71). One of the samples was very good, and of considerable length, probably the best sample exhibited in quality. The others were of medium quality, the winter hair being shown to contrast with the long summer clipping.

John O'Connor (No. 72). A sound useful mohair, but wanting in fineness of fibre.

Gert Pretorius (No. 73). Sample long and bright, but rather too strong in the fibre.

John G. D. Rex (No. 74) exhibited a very wide range of samples, but unfortunately the tickets of the respective lots were mixed in the transit, and it was not possible with certainty to identify the various specimens with the catalogue. This is all the more to be regretted as the classification was most complete, each numbered sample being separately described. One

sample was quite worthless, and several others very poor-bred, coarse, and lustreless; two or three were of better quality with fair lustre, and one sample was very good indeed, and if it had been finer in the fibre would have been of the highest class.

Savage and Hill (No. 75). No sample obtained.

A. F. Strauss (No. 76). This exhibit was good in general character, the fibre long and silky, but, like many of the other samples, coarse in the fibre.

Theophilus Bros. (No. 77). The quality was good in every respect, and the lustre high, but some part of the exhibit was defaced by cots in the hair.

F. F. Wienand (No. 78). A specimen of mohair, long and silky, but not very fine in the fibre.

Considering the short time that the Angora goat has been introduced into the Colony, the exhibit of mohair was very encouraging, but when all the samples were compared with the highest class of Turkish fibre the want of lustre and lack of fineness in the fibres was easily seen. The latter defect was present in all the samples exhibited, and special attention should be directed to this matter which is of the utmost importance. The strong high-bred Turkish goats which have been introduced evidently influence the strength of hair in the native breed, and care should be taken to select the goats with the finest hair for stock purposes, as, if the fibre can be rendered less robust in character, and the lustre and length maintained, the Cape mohairs have a great future before them.

The wool exported from Cape Colony in 1885 was 34,432,562 lbs.; mohair 5,251,301 lbs.

NATAL.

The character of the exhibit in this Court was very similar in the quality of the wools shown to those in the section of the Cape Colony, and also included samples of mohair. The exhibit was made in two long museum cases divided into compartments, within which a ticket gave the name of the exhibitor and nature of the wool. Most of these wools were from pure or part-bred merinos, and many of them were excellent examples of this class of wool. They included both carding and combing qualities, and numbered about thirty-seven examples, shown by fourteen exhibitors.

Thomas Foster (Nos. 170 to 177) showed very good samples of merino wool; some of the samples were of very fine quality. Altogether this exhibit was very creditable.

James A. Lindsay (Nos. 178, 189, 200). These wools were also of good quality.

George Turner (No. 179), P. A. R. Otto (Nos. 181 and 182), Philip Norton (Nos. 183 and 184), P. H. van Rooyen (Nos. 185 and 186), and Gert Van Rooyen (No. 187) exhibited examples of merino lambs-wool; some of these were of very fine quality.

Messrs. King (No. 180) showed good examples of merino.

A. C. Nicholson (No. 188), and Alexander Stone (188A) exhibited fine merino lambswool.

William Watson (Nos. 190 to 194) made an excellent exhibit of fine merino carding and combing wools. These were all of very good quality, and were very fine samples of this class.

William Proudfoot (No. 195) showed samples of fine merino wool.

A. H. Manning (Nos. 197 and 198) exhibited examples of cross-bred Leicester and merino wool; they were of good quality.

T. K. Taylor (No. 199) and G. Van Rooyen (No. 201) showed samples of lambs and merino ewes wool. Both these were of excellent quality (especially the latter).

Flack Bros. (Nos. 203 to 205) showed examples of scoured wool, both fine and coarse; also several examples of merino wool, some of which were of fine quality.

Several samples of mohair were also shown in this section.

George H. Wright (No. 196) showed fleeces of Angora hair. These were not very fine in quality, but had a high lustre and length.

John Gibson (No. 205 A) exhibited some good samples of mohair. They were of first-class quality as regards lustre and strength, but rather strong in the fibre, like most African mohair.

The quantity of wool exported from this Colony in 1885 was 17,906,044 lbs.

TASMANIA.

It is much to be regretted that no exhibit was made by this Colony either of wool or other products, because the high character of many of the Tasmanian wools, and the attention which has been paid in this Colony to purity of breed and high culture would have rendered the exhibit in the highest degree interesting, if only for comparison with the other Colonial wools.

GENERAL REMARKS.

As already remarked, the wide range over which the growth of the wool extended, and the difference in climatic and other conditions to which the sheep in the various Colonies were subjected, rendered the present opportunity most valuable in making a comparative examination of the different wools. This survey brought home to the eye most forcibly the very wide range of conditions under which the sheep can be cultivated, and the high state of perfection to which it can attain, in almost every part of the world, when due attention is paid to culture and breed. It seems to indicate that special classes of sheep are more adapted to certain regions of the earth's surface than others, and that in many cases the environment of the sheep tends, in the course of generations, under careful management, to produce a special character which becomes permanent and may be retained as a pure breed. It also shows that certain characteristics of the wool, such

as lustre in the long-woolled breeds, can only be retained permanently by the re-introduction of fresh blood from time to time—at any rate, in all the regions which lie nearest to the equator, a certain degree of equability of temperature and atmospheric moisture being necessary for its permanence. Thus it appears to be retained longest in New Zealand and the southern coast of the Australian Continent. The nature of the herbage also affects the quality of the wool in a marked degree, and probably one of the chief reasons why the Australian merinos deteriorate when introduced into the Cape Colony is because the herbage is not fitted for the highest development of the sheep. One very marked lesson of the Exhibition is the fact that all the best wools exhibited show that whatever tends to improve the character of the sheep in any one direction re-acts all round in a benefit to all the other characteristics. The same conditions which tend to increase the size of the sheep cause the wool to be better nourished, firmer and more tenacious, without injury to the best qualities of the fibre, provided care is taken in the proper selection and purity of breed in the sheep. The question of difference in the lustre of the wool is an important one, and opens a wide field for investigation. It has been already noticed that the Victorian wools stand foremost in this respect amongst the merinos. When the fibres are examined with the microscope it appears that while the fibres are equally fine when compared, say with those from New South Wales, or South Australia, the development of the individual scales on the surface is larger, and they present fewer scales in the linear inch. On the other hand, as the fineness in diameter is maintained in the less lustrous fibres, the development of the scales is greater in number, and this gives a greater softness and pliability to the individual fibres with a larger degree of serration, and therefore a higher felting power. It is for this reason probably that the wools of New South Wales are more adapted for the fine clothing trade than the more lustrous Victorian, or the coarser fibre wools of South Australia. The judicious introduction of the best characters of certain classes of sheep into other breeds, as is clearly shown, may induce a permanent improvement of the new breed, only under certain conditions, and it seems now beyond a doubt that it will always be necessary for the farmer to discover the special class for which his own climate and surroundings are the most advantageous if he is to attain the highest perfection in the production of wool. Those who are growers of wool must remember that every year the demand for quality in the raw material is greater, and those only who aim at securing all the best properties which wool can possess will secure the markets of the future.

In several instances "kemps" were found associated with the wool. These kemps are fibres, usually shorter and thicker than the others, in which all traces of wool-structure are absent. They are brittle, solid, and ivory-like. This is the sure indication of want of trueness in breed, and is most objectionable, as these kempy fibres will neither felt nor take any dye. They cannot be removed from the fleece by any process, except picking them out, and hence they injure the quality of any goods for which the wool may be used. This defect was specially noticed in some of the cross-breds with the long-woolled sheep, and where it exists the value of the wool is most seriously deteriorated.

Nothing can compensate for the want of condition in the wool when sheep are neglected, and it cannot be too strongly urged that every

endeavour should be made to maintain in the bulk the high standard presented in the samples exhibited. Without this care and due attention to classification the results of good breeding and cultivation may all be lost, and rendered commercially unremunerative.

An endeavour was made in preparing this report by examining each specimen exhibited in relation to the geographical position in which it was grown, to determine, if possible, whether any general law with regard to characteristic properties could be drawn from this relation, but the differences in the breed of sheep, and in the care and attention bestowed on the wool, rendered any sound deduction impossible, and it therefore appears probable that selection of breed, good pasturage and attention have far more influence than mere geographical position within the range of the temperate zone.

In conclusion, the author of this report begs to record his high sense of the uniform kindness and courtesy which he experienced from all the officials in charge of the various Colonial exhibits and from the Executive of the Exhibition. This was all the more appreciated as it involved, on their part, from the number of samples and variety of information required, a large amount of labour and time.

SILK.

By THOMAS WARDLE, F.C.S.

I HAVE undertaken the task of describing the exhibits of Colonial Silks at the Colonial and Indian Exhibition with much pleasure, and I have entered more thoroughly into the subject from a conviction that several of our Colonies may be made in time and under auspicious circumstances to rival other silk-producing parts of the world. At the present time it is estimated that the total production of raw silk annually is 20,000,000 lbs., and no doubt this quantity, large as it is, would be materially increased, could the product be cheapened and its maximum and minimum prices be brought within less varying limits, which would undoubtedly be the case with increased supplies and a more widely spread area of production. No doubt this increase of production could be accomplished, the climate of some of our principal Colonies being exactly suited to both the growth of the mulberry tree and to the healthy rearing of the silkworm. It seems worth an effort to show that every encouragement should be given to this important and beautiful industry.

Although at the present time labour is so costly in the Colonies that silk-reeling cannot be profitably practised, it may be useful to give a description of the appliances which are deemed the simplest, and at the same time the best, and which are used where the most perfected reeling of cocoons is conducted, namely, in France and Italy. I have so modified these appliances, without in any way impairing their utility, as to bring them within the reach of any cottager in price and portability, in order that cottage reeling may be carried on as a domestic industry, without necessarily interfering with other industries, in houses where there is a family.

The following are the reeling appliances required :—

A cast-iron furnace for heating the reeling basin.
A reeling basin which contains water and the cocoons to be reeled.
A tavelette.
A reel upon which the silk is drawn off from the cocoons.

The tavelette is supported on a rod of cast iron fixed in front of the reeling basin. The filière is a perforated porcelain button through which the multiple thread from the cocoons passes to the tavelette. An eyelet guider conducts the thread to two small pulleys, from which, after being twisted round itself from six to twelve times, it passes through an upper eyelet guider, and is carried to the reel.

I am having several of these machines constructed for the Government of India, and for several native Indian States and other places, as working models. The importance of having the best method of reeling cannot be over-estimated. I am introducing some modifications to simplify the reeling, so as to enable it to be used in the cottage as well as the factory. I shall be happy to have duplicates made and sent out to any person wishing to have them. The cost will not exceed £8.

In the following tables of notes of laboratory examinations of cocoons,

where the percentage of silk reeled from the cocoon is stated, it must be understood that the cocoon when weighed contained the *dried* chrysalis.

Considering the short time which has elapsed since the close of the Exhibition and the publication of this Report, it can hardly be expected that all the results of experiments on the properties of the silken fibre of the cocoons examined are absolutely free from error, although the experiments have been most carefully made. I intend traversing again the whole series during the next twelve months, and if any errors are found, their corrections will be notified. But I believe they may, as they stand, be taken on the whole to be scientifically and practically accurate.

CANADA.

To Canada must be accorded first rank in Colonial silk productions. Silk manufacturing has taken root and is evidently a success, both in silk fabrics and in sewing and embroidering silks.

To give some idea of these it will be necessary to describe them at considerable length.

At the Corriveau Silk Mills, St. Hyacinthe, Montreal, Quebec, are manufactured broad silks, gros grains, satins, serges, brocades, armures, plain satin and fancy ribbons, handkerchiefs and mufflers.

M. Corriveau informs me that all their goods are of home manufacture, and are made from imported raw silk. They dye their own silks as well as finish them. They also make part of their own machinery. Their goods are pure silk, unmixed with any other material. The principal part of the raw silk they use is from Italy and the Cevennes, but they also sparingly use Japan silk. The silk workers are mostly Canadian, and have been trained by the proprietors.

They also exhibit sewing and embroidery silks which they state are of their own manufacture.

I consider their exhibit to be of much interest, and to reflect great credit on their enterprise and skill.

A most imposing and important exhibit was contributed by Messrs. Belding, Paul & Co., of Montreal, which it will be necessary to describe. Its leading feature consisted of silk thread for sewing and embroidery purposes exhibited in a fine square case, in columns of spooled silk upon bases of ribbons. The name of the firm was annexed in letters formed of white and yellow cocoons.

The various articles in this exhibit may be enumerated as follows:—

1. Machine silks in light colours, beautifully arranged as was the case with every part of this interesting exhibit.
2. Shaded embroidery silks.
3. Black machine silks.
4. Tailors' twists.
5. Coloured twists.
6. Shaded embroidery silks on spools.
7. Filoselle in light shades.
8. Knitting silks.

9. Button-hole twists made up on spools, in twelve threads, in the manner of the like productions of Leek which is celebrated for its various sewings, twist and embroidery silk manufactures.

10. "Kensington" embroidery silks.

11. Picot edge ottoman.

12. Satin faille and rich faille.

13. Stacks of ribbons in various colours.

Messrs. Belding, Paul & Co.'s principal factory is in Paterson, New Jersey, U.S.; but they employ several hundred hands in Montreal, chiefly in the manufacture of sewing silk which is shown in the present exhibit. The dyeing of the silks exhibited has been done with very creditable skill.

It does not appear that there is any manufacture of which silk forms a part, the mixture of silk with other fibres not being practised in Canada, except perhaps in the case of tweeds in which a few threads of silk are introduced in the warp.

There was a number of ornamental articles exhibited, in which silk formed the ground for decoration, or was the decorative part itself, chiefly done by ladies. Amongst those of the greatest interest were the following:—

1. An embroidered sofa pillow of chenille on satin, by Miss Longley, of St. John, New Brunswick.

2. A perpime sachel in the same materials, by Miss Perry.

3. A chair-back cushion, also chenille embroidery on red plush, by Miss Thurmott.

4. A very curious patchwork quilt, made by Miss Potter, from bits of silk and wool collected by two girls from ladies in nearly every street in Halifax.

5. Embroidered cushion, by Mrs. L. Jacobs, of Caughnawaga, Quebec.

6. A parti-coloured crazy-work table-cover, made of 900 pieces of silk—a great achievement. Exhibited by Miss McDonald, Halifax, Nova Scotia.

7. A crazy quilt and sofa pillow, the quilt somewhat similar to Miss McDonald's, but with red plush border and embroidered corners. By Mrs. P. F. Payan, of St. Hyacinthe, Quebec.

8. A crazy-work table-cover, by Mrs. Silas F. Duclos, sister to Mrs. Payan.

9. Four beautifully embroidered banner screens on silk, by Miss A. B. Fairbanks, Dartmouth, Nova Scotia. The ground was on black satin with plush borders, and the following flowers were embroidered on the satin:—

Mayflower (*Epigea repens*) or Trailing Arbutos.

Pigeon-berry, blossom and fruit.

Snapdragon.

Indian pitcher plant or Jack-in-the-box.

These embroideries evinced both culture and great taste.

10. Another effective embroidery of a peacock on black satin, the effect being heightened and balanced by the addition of a red flowering shrub. By Miss E. Wade, of Belleisle, Annapolis, Nova Scotia.

11. An effective piece of tapestry work about four feet high and three feet broad. The subject was Mary Queen of Scots, the face and hands being painted and the other parts worked in wool and silk. By Mrs. Lavinia Sparrow, of Napanee, Ontario. Lent by the Hon. John Pope, of Ottawa.

12. Another form of silk decoration in which the Canadian ladies display much ability is painting on silk, an old and beautiful mode of ornamentation and pleasure-giving work, both in Europe and the East, and particularly in China where it is done perfectly.

There were nine d'Oyleys beautifully painted on white satin with roved edges, in the following subjects:—Maplé leaves, Dandelion and Willow, American true-love, Clover, Wild violets, Linnac, Ladies' slipper, Wild rose, Pigeon berry. I regret I could not learn the painter's name. These subjects were treated in a really charming manner.

13. Miss M. Kinsman, of Kentville, Nova Scotia, had a hand-painting on plush of merit.

14. Miss Margaret Pope, of Summerside, Prince Edward Island, exhibited two panels for a banner, with subject-paintings of "Indian and Squaw" and two "Toboggan Canadian Winter Scenes."

There were also interesting exhibits in needle and other work by several other ladies, altogether giving a pleasing impression of so enjoyable a mode of passing the time where winter evenings are long and travelling not easy.

There were no sericicultural exhibits. Neither cocoons nor raw silk are produced in the Canadian Dominion. The silk of commerce, being produced by the mulberry-fed worm (*Bombyx mori*), can find no prospect of a future here owing to the climatic conditions being unfavourable to the growth of the mulberry tree.

I noticed, however, with much pleasure splendid collections of Canadian Lepidoptera, amongst which were several species of wild silk-producers of great interest.

Professor William Saunders, F.R.C.S., President of the Entomological Society of Ontario, exhibited two cases of Samia, Telea, Actias, Collosamia, Hypercheria, and Eacles, which strongly suggested that greater attention from a sericicultural point of view should be paid to these cocoon producers.

I strongly suggest and urge the Canadian authorities to send over to England a complete list of indigenous silk-producers, as well as examples of eggs, larvæ, and moths, in all cases accompanied by their cocoons. For sericicultural work this is, of course, absolutely essential.

The great success which has attended my efforts for the utilisation of the wild silks of India greatly encourages and warrants this suggestion.

I am engaged in the examination of all fibres of silk, whether at present brought into utility or not, with a view of reporting upon their adaptability for reeling or spinning, their power of tinctorial absorption, their strength, thickness, and elasticity, and in every way which is likely to tend to their ultimate use commercially, and I should be glad to receive from time to time any specimens which may be collected, whether of known or hitherto unknown species, and still more so if the Executive Commission of this great Dominion would aid me in this work.

There are no doubt many entomologists in Canada who would be glad to forward specimens if only requested.

I am sorry I have not materials at hand now to publish some information about Canadian wild silk-producing Lepidoptera. Any and all species which make cocoons would be gladly received, and would have careful examination and report.

I find the Canadians impose a duty of 30 per cent. to 35 per cent.

on English silks imported, and the same on those of America and other countries. It is a pity for the sake of the silk industry that there is not a more favourable tariff, at least for England. Such high duties only lead to adulteration by loading silk with mineral matter, so reducing its economic value.

NEW SOUTH WALES.

Sericiculture has not made much progress in this Colony, although it seems to have a suitable climate, stated to be approximate to that of Southern Europe. With a population close upon a million, there is room to suppose that families might be found to attend to the rearing of silkworms and to the collection of cocoons.

In the New South Wales Court I found only two exhibits of silk. In Class 51, No. 332, Mr. Charles Anthony Brady, of Tumbulgum, Tweed River, exhibited some buff-coloured cocoons partially sun-dried. The source from which the eggs were obtained was not stated, but it was probably Italian or French.

Mr. George Thorne, of Castle Hill, Parramatta District, also had a very interesting case of cocoons, white, green, and buff, both whole and pierced, together with silkworm eggs, which hatched during the Exhibition, and were fed on lettuce leaves in my living silkworm cases in the Indian Silk Culture Court. Dried leaves of the white mulberry tree (*Morus alba*) were also shown. This exhibit also included examples of good waste silk and floss obtained in 1884, and some boiled cocoons.

The following are notes of my laboratory examinations of the three varieties of mulberry silkworm cocoons exhibited in the New South Wales Court:—

COCOONS NO. I.

Species of cocoon, with name and address of producer and exhibitor.—Mulberry-fed silkworm cocoon (*Bombyx mori*). Produced by G. Thorne, Castle Hill, Parramatta District, New South Wales, and exhibited by him in the New South Wales Court, Class 51, No. 333.

Description of the cocoon and its silk fibres.—Form: elliptical-oblong, with slight medial depression. Colour: light buff outside, but yellow inside. Texture: rather loose, the silky walls of the cocoon being composed of successive layers. The reelable cocoon thread or *bave* is composed of two cylindrical fibres or *brins*, consisting of homogeneous matter (*fibroïn*, Schorlemmer) surrounded and cemented together by a substance resembling gelatine (*sericin* or silk-gelatine, Schorlemmer). This latter is called "gum" in England and "grès" in France. As with other mulberry silks, the two *brins* polarise light very beautifully when the *bave* is examined with the microscope and polariscope, but the surrounding silk-gelatine, which forms about 33 per cent. of the total weight of the *bave*, has no polarising power.

Weight of cocoon.—0·727 grammes.
Dimensions of cocoon.—35 × 19 millimetres.
Length of bave reeled.—615 metres.
Weight of bave reeled.—0·190 grammes.
Titre of bave, milligrammes per 500 metres.—154 milligrammes.
Titre of bave, in deniers.—2·89.
Mean diameter of bave.—0·0336 millimetres.
Mean elasticity of bave.—20·77 per cent.
Mean tenacity or strength of bave.—8·53 grammes.
Percentage of silk reeled from the cocoon.—26·13 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	* 322 irregular	345	340
Percentage of elasticity. Average of six estimations	† 13·3	24·3	24·7
Tenacity or breaking strength in grammes. Average of six estimations	‡ 6·25	10·27	9·07

	I.	II.	III.	IV.	V.	VI.	VII.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	31	35	34	32	32	26	15 metres remained.

Cocoons No. II.

Species of cocoon, with name and address of producer and exhibitor.—Mulberry-fed silkworm cocoon (*Bombyx mori*). Produced by G. Thorne, Castle Hill, Parramatta District, New South Wales, and exhibited by him in the New South Wales Court, Class 51, No. 333.

Description of cocoon.—Form: elliptical-oblong, without any medial depression, ends rather pointed. Colour: very light greenish-yellow outside, creamy-white inside. Texture: fairly compact, though the silken walls of the cocoon are separable into successive layers. Reeling: good. The description of the bave of Cocoons No. I. applies equally to Cocoons No. II.

Weight of cocoon.—0·693 grammes.
Dimensions of cocoon.—35 × 18 millimetres.
Length of bave reeled.—418 metres.
Weight of bave reeled.—0·146 grammes.
Titre of bave, milligrammes per 500 metres.—175 milligrammes.
Titre of bave, in deniers.—3·27.
Mean diameter of bave.—0·0355 millimetres.
Mean elasticity of bave.—20·8 per cent.
Mean tenacity or strength of bave.—9·67 grammes.
Percentage of silk reeled from the cocoon.—21·07 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

* 322 ten-thousandths of a millimetre equal $\frac{1}{78}$ inch, as will be seen from the following calculation:—$\frac{1}{10000}$ millimetre = 0·00003937 inch, ∴ $\frac{322}{10000}$ millimetre = 0·001267714 inch or $\frac{1}{78}$ inch.

† *i.e.* 100 inches of *bave* will stretch or extend before breaking to 113·3 inches.

‡ 6·25 grammes = 0·2204375 oz. avoirdupois by the following calculation:—1 gramme = 0·03527 oz., and 0·03527 × 6·25 = 0·2204375.

The diameter and strength of the *bave* or natural pair of fibres are of course double those of the single fibre or *brin*.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	372	397	295
Percentage of elasticity. Average of six estimations	17·8	26·7	17·9
Tenacity or breaking strength in grammes. Average of six estimations	10·3	13·2	5·5

	I.	II.	III.	IV.	V.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	45	41	34	24	18 metres remained.

Cocoons No. III.

Species of cocoon, with name and address of producer and exhibitor.—Mulberry-fed silkworm cocoon (*Bombyx mori*). Produced by C. A. Brady, Tumbulgum, Tweed River, New South Wales, and exhibited by him in the New South Wales Court, Class 51, No. 332.

Description of cocoon.—Form: elliptical-oblong, with slight medial depression. Colour: creamy-white inside and outside. Texture: fairly compact. Reeling: good. The description of the bave of Cocoons No. I. applies equally to Cocoons No. III.

Weight of cocoon.—0·634 grammes.
Dimensions of cocoon.—32 × 16 millimetres.
Length of bave reeled.—554 metres.
Weight of bave reeled.—0·159 grammes.
Titre of bave, milligrammes per 500 metres.—144 milligrammes.
Titre of bave, in deniers.—2·70.
Mean diameter of bave.—0·0328 millimetres.
Mean elasticity of bave.—18·1 per cent.
Mean tenacity or strength of bave.—6·7 grammes.
Percentage of silk reeled from the cocoon.—25·08 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	345	345	294
Percentage of elasticity. Average of six estimations	16·7	22·8	14·9
Tenacity or breaking strength in grammes. Average of six estimations	7·7	8·5	3·9

	I.	II.	III.	IV.	V.	VI.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	41	37	33	28	15	54 metres remained, weighing 5 milligrammes.

Mr. Brady in a printed circular states that the climate on the Tweed River furnishes the mulberry tree in great abundance, yielding daily supplies of the leaf from the end of July until April. The soil, he says, is very fertile, the rainy season being from January to April, and followed by a dry winter.

He states that he has for many consecutive years, aided by the power of the climate and country, managed to obtain a continuous hatching of silkworms day by day or week by week; or in his own words, "Assuming that the management of the eggs has been duly attended to at the proper time . . . the continuous hatchings will present the strange phenomenon peculiar to New South Wales, of living silkworms in every daily or periodical stage of progression up to cocooning (every day's lot must be kept severely separate)—that is, worms of every stage and daily growth, and through every moult and change of forms (metamorphosis) contemporaneously, and at the same time the emerging and coupling of the moths and deposit of the eggs (the graine again). This continues till operations for the season are finally closed, when the staff employed can respite for a winter, during which refit and preparations are made for the following season.

"The whole of the natural history of the mulberry silkworm, absolutely unchanged in its annual habit, is in view at one and the same moment—worms hatched on the day itself, and of every other day's, from one day old to full-grown ones, actually making their cocoons; the moths emerging, and new eggs being produced, which are a generation to proceed with in a subsequent season. Arranged beforehand, and in the hands of a skilled person, the process is as much under control as the machinery in a factory. It is animated, self-reproducing machinery, maintained by supplies of the silkworm's only natural food—the mulberry leaf."

VICTORIA.

I was received in this Court with much kindness by the President of the Victorian Commission in London, Joseph Bosisto, Esq., J.P., who had given some attention to sericiculture in his various travels.

The only exhibit of silk in this Court was one sent by the Superioress of the Convent of the Good Shepherd (Sister Mary C. Curtain), Abbotsford. It consisted of cocoons and raw silk called in the catalogue "Unprepared Floss Silk."

At the Amsterdam Exhibition Mrs. Bladon Neale exhibited a glass case of cocoons from Mrs. Timbrell's silk farm in Victoria. This case was sent on to the Colonial and Indian Exhibition, but was not exhibited owing to the damaged condition of its contents. Mr. Bosisto, however, sent it to my office, and after careful examination and re-arrangement, I found it to contain really good cocoons quite of equal commercial value to those of any country.

The following are notes of my laboratory examinations of these cocoons. Their silk fibre will be seen to be somewhat deficient in strength, the reason of this being, that owing to the cocoons having been sent over for

exhibition in the Amsterdam Exhibition of 1883 and having been kept in the case since that time, they have suffered in some way, probably from dampness. I have no doubt originally the strength of their silk fibre was quite equal to that of the fibre of any of the other cocoons examined :—

Species of cocoon.—Mulberry-fed silkworm cocoon (*Bombyx mori*).
Description of the cocoon and its silk fibres.—Form : elliptical-oblong, with slight medial depression. Colour : creamy-white. Texture : compact. Reeling : fairly good. See the remarks about the bave under the head "Cocoon No. I.," New South Wales Report, which are applicable here also.
Weight of cocoon.—0·221 grammes.
Dimensions of cocoon.—28 × 12 millimetres.
Length of bave reeled.—377 metres.
Weight of bave reeled.—0·070 grammes.
Titre of bave, milligrammes per 500 metres.—93 milligrammes.
Titre of bave, in deniers.—1·75.
Mean diameter of bave.—0·0202 millimetres.
Mean elasticity of bave.—21·73 per cent.
Mean tenacity or strength of bave.—6·57 grammes.
Percentage of silk reeled from the cocoon.—31·67 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	205	218	184
Percentage of elasticity. Average of six estimations	24·8	22·9	17·5
Tenacity or breaking strength in grammes. Average of six estimations . . .	7·5	7·7	4·5

	I.	II.	III.	IV.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon.	21	25	16	77 metres 8

I noticed in the excellent entomological collection in this Court several species of the genus *Antheræa*, of which I was promised duplicates. Mr. Bosisto thought *Antheræa pernyi*, the Tussur silkworm of China, would flourish in Victoria. It is an oak-feeder. I have no doubt several species of the wild or semi-domesticated silkworms of India might be found capable of acclimatisation, and I would recommend eggs to be obtained from India and China. Particulars of all the known species will be found in my "Handbook of the Wild Silks of India," published by the Lords of the Committee of Council on Education, and also in the Descriptive Catalogue of the Indian Silk Culture Court of the Colonial and Indian Exhibition, to which I would refer persons intending to experiment in sericiculture.

In writing of the silk of this Colony, it is most important that I draw attention to an excellent work of Baron Ferd. von Mueller, K.C.M.G., F.R.S., &c., Government Botanist for Victoria, entitled "Select Extra-Tropical

Plants, really eligible for Industrial Culture or Naturalisation." It was published at Melbourne in 1885, and contains under the head of *Morus alba*, the best account I have yet met with of the different species and varieties of the mulberry, their relation to Colonial sericiculture and their importance in silk-producing countries. This account is of so much importance, that I think it best to copy some portions of it to form part of my Report, as it is in every way calculated to give encouragement not only to silkworm-rearing in Victoria, but in every part of the British Colonial Empire.

Its subject is one to which I had opportunity of bestowing much attention last year in India, where I found inadequate knowledge of the cultivation of the mulberry. In Bengal *Morus Indica* is cultivated as a shrub and not as a tree. In China the worms feed on the leaves of *Morus chinensis*, and in Italy on those of *Morus alba*.

Baron Ferd. von Mueller says:—

"The White Mulberry-tree is found in Upper India and Western China. This tree in several varieties provides the food for the ordinary Chinese silk-insect (*Bombyx mori*). Silk was produced in Italy 700 years ago, and this branch of industry has flourished there ever since. In China silk has been reeled for 4500 years; this may demonstrate the permanency of an industry, which we wish to establish extensively anywhere under a similar sky.

"The White Mulberry-tree is of extremely easy growth from cuttings, also readily raised from well-matured seeds. It is usually unisexual, and finally attains a very large size. It can still be grown in climes where olives will no longer thrive. In Norway the tree bore seeds in lat. 59° 55′ (Schuebeler). Spots for mulberry-culture must not be over moist, when the leaves are to be utilised for the *Bombyx*.

"Superior varieties of mulberry can be grafted with ease on ordinary stock. *M. Indica*, L., *M. macrophylla*, Moretti, *M. Moreitiana*, Jacq., *M. Chinensis*, Bertol., *M. latifolia*, Poir., *M. Italica*, Poir., *M. Japonica*, Nois., *M. Byzantina*, Sieb., *M. nervosa*, Del., *M. pumila*, Nois., *M. tortuosa*, Audib., as well as *M. Constantinopolitana*, Lamarck, with which, according to Prof. C. Koch, is identical *M. multicaulis* of Perrottet, are merely forms of *M. alba*, to which probably also *M. Tatarica*, L., and *M. pabularia*, Jacquin, belong. The variety known as *M. Indica* produces black fruits. The raising of mulberry-trees has recently assumed enormous dimensions in California, where between seven and eight millions were planted since 1870. The process of rearing the silk-insect is simple, and involves no laborious exertions. The cocoons, after they have been properly steamed, dried and pressed, readily find purchasers in Europe, the price ranging according to quality from 3*s*. to 6*s*. per lb. The eggs of the silk-moth sell at a price from 16*s*. to £2 per oz.; in 1870, Japan had to provide two millions of ounces of silk-ova for Europe, where the worms had extensively fallen victims to disease. As an example of the profit to be realised, a Californian fact may be cited, according to which £700 were the clear gain from 3½ acres, the working expenses having been £93. The Commissioner of Agriculture of the United States has estimated that under ordinary circumstances an acre should support from 700 to 1000 mulberry-trees, producing, when four years old, 5000 lbs. of leaves fit for food. On this quantity of leaves can be reared 140,000 worms, from which ova at a

net profit, ranging from £80 to £240 per acre, will be obtained by the work of one person. Mr. C. Brady, of Sydney, thinks the probable proceeds of silk-culture to be from £60 to £150 for the acre. The discrepancies in calculations of this kind are explained by differences in clime, soil, attention, treatment and also rate of labour.

"A very palatable fruit is obtained from a variety cultivated in Belochistan and Afghanistan. *Morus Tatatica*, L., resembles *M. alba;* its juicy fruit is insipid and small. The leaves are not generally used for silkworms. The white-fruited tree was found apparently wild by Dr. A. v. Regel, at Taschkent and Tutkaul; the stems there were 7 feet thick.

"The results of Mr. Brady's experience on the varieties of *Morus alba* are as follows:—In the normal form the fruits are white with a purplish tinge more or less deep; the bark is pale; the leaf is also of a pale hue, not very early, nor very tender, nor very abundant. It may be grown on moist ground, so long as such is drained, or it will live even on poor, loose, gravelly soil, bordering on running water. The Cevennes variety is a free grower, affords a large quantity of leaves, though of rather thick consistence; all varieties of the *Morus Bombyx* like these leaves, whether young or old; it is also called the Rose-leaved variety; the silk which it yields is substantial in quantity and also good in quality; it does best on rich dry slopes. The bushy Indian variety has a fine leaf of a beautiful green, which, though light in weight, is abundantly produced; it can be cut back to the stem three or four times a year; the leaves are flat, long and pointed, possess a fine aroma, and are relished by every variety of the ordinary silk-insect, though all do not thrive equally well on it; the silk derived from this variety is excellent, but not always so heavy in quantity as that produced from the rosy variety; it prefers rich, low-lying bottoms, is a greedy feeder, but may thus be made to cover an extraordinary breadth of alluvial or manured land in a marvellously short space of time. At Sydney Mr. Brady can provide leaves from this Indian variety all through the year by the removal of cuttings, which will strike their roots almost at any season; it also ripens seeds readily, and should be kept at bush-size; it requires naturally less space than the other kinds. A fourth variety comes from North China; it has heart-shaped, flat, thickish leaves, which form very good food for the silkworm. Mr. Brady, as well as Mr. Martelli, recommend very particularly the variety passing under the name of *Morus multicaulis* for the worms in their earliest stages. The former recommends the Cape variety also; the latter wishes likewise the variety called *Morus Morettiana* to be used on account of its succulent nutritious foliage, so well adapted for the insect, while yet very young, and also on account of producing the largest amount of food within the shortest time. The Manilla variety, above mentioned as *Morus multicaulis*, comes into bearing several weeks earlier than most other sorts, and should therefore be at hand for early hatched worms. An excellent phytological exposition of the numerous varieties of the White Mulberry-tree is given in De Candolle's Prodomus, XVII. 238–245 (1873).

"The Muscardine-disease is produced by *Botrytis Bassiana*, while the still more terrible Pebrine-disease is caused by a minute psorospermous organism. On the Pebrine Pasteur's researches since 1865 have shed much light. Countries like ours, happily free from these pests, can thus rear healthy silk-ova at a high premium for exportation.

"The White Mulberry-tree, with others, offering food to the silkworms, such as the osage-orange, should be planted copiously everywhere for hedges or copses. A very soft textile fibre is obtained from the bark of the Chinese mulberry-tree."

As to the statistics given by Baron von Mueller, there are one or two errors; for instance, he states that one pound of silk is worth its weight in silver. This is not so, one pound of Italian raw silk, at the present time, being only worth about *22s.*

Perhaps I ought not to omit mention of an exhibit described in the Catalogue of the Victorian Court, at page 56, by Mr. James Wilde, "Dorset Cottage," Mollison Street, Collingwood, of a "Fancy Silk Loom in motion for weaving silk brocades for ladies' and gentlemen's wear; also a quantity of silk goods manufactured by machine." I did not, however, see this exhibit.

SOUTH AUSTRALIA.

This Colony extends from north to south, directly through the centre of Australia.

A good deal of encouragement is being given here to sericiculture by Sir Samuel Davenport, K.C.M.G., Assistant-Executive Commissioner in London for South Australia at the Colonial and Indian Exhibition, and President of the Chamber of Manufactures in Adelaide, and by Lady Davenport, who was the first to introduce silkworm culture into this Colony.

An excellent exhibit of white cocoons was made by Dr. W. Lennox Cheland, Resident Medical Officer of the Parkside Lunatic Asylum. These cocoons had been sent over in considerable quantity, and I undertook to have them reeled, and the resulting raw silk made into silk fabrics. I obtained 3 lbs. 14 oz. of raw silk, and Messrs. J. Birchenough and Sons have thrown and manufactured it into a beautiful series of handkerchiefs, &c., and have sent me the following report of it:—"The silk reeled at Leek from Australian cocoons is on the whole very satisfactory. As a winding silk it is superior to China silk, and about equal to a good Japan or Italian. Its elasticity is not so good as the last two classes of silk, and in places the thread has a tendency to split, and where this occurs the result is disappointing. There seems to be an absence of gum, which will account in some degree for this slight fault. The silk is clean, and would be passed as a good silk for a throwster, there being an absence of slubs, knibs and dirt, which is greatly in its favour. The general sizes seem to be 16 to 20 deniers, but it will range from about 10 to 24 deniers, single thread. As to its value, it is difficult to assess it until it has passed through every process; but to judge from the present appearance and values, it should be worth about *20s.* per lb." The cocoons were reeled by the French reeler who was sent over to the Exhibition by the kindness of the Chamber of Commerce at Lyons, through the instrumentality of Monsieur J. Dusuzeau, Directeur of the Laboratoire de Sériciculture of Lyons. After the close of the Exhibition the reeler came down to Leek and reeled the cocoons in the

adjoining house to my own, where I had daily opportunities of observing the work. The reeling machine used was similar to that employed at the Exhibition, but of a more simple and economical construction. I have had it made to send out to India as a Government pattern, and would strongly recommend its adoption to those in Australia who wish to reel cocoons. It contains all the elements of the best appliances of Italy, the use of which I have studied, but so simplified as to be capable of cottage use, for which purpose in India I have designed it in order to give so agreeable an occupation to the women there whose caste customs of almost perpetual indoor life are well known.

Many particulars respecting this method of reeling, and of the silks of silk-producing countries will be found in my Descriptive Catalogue of the Indian Silk Culture Court above referred to.

The following is the result of my laboratory examinations of the cocoons before-mentioned, exhibited in the South Australian Court:—

Species of cocoon and Colony in which it is produced.—Mulberry-fed silkworm cocoon (*Bombyx mori*), South Australia.
Description of cocoon.—Form: elliptical-oblong with slight medial depression. Colour: white. Texture: compact. Reeling: good. Bave composed of two cylindrical structureless brins.
Weight of cocoon.—0·366 gramme.
Dimensions of cocoon.—35 × 16 millimetres.
Length of bave reeled.—497 metres.
Weight of bave reeled.—0·162 gramme.
Titre of bave, milligrammes per 500 metres.—163 milligrammes.
Titre of bave, in deniers.—3·06.
Mean diameter of bave.—0·0473 millimetre.
Mean elasticity.—24·07 per cent.
Mean tenacity.—13·43 grammes.
Percentage of silk reeled from the cocoon.—44·26 per cent.

Trials of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	483	508	427
Percentage of elasticity. Average of six estimations	25	27·5	19·7
Tenacity or breaking strength in grammes. Average of six estimations	13·6	15·4	11·3

	I.	II.	III.	IV.	V.	VI.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	30	32	36	37	97 metres remained, weighing 27 milligrammes.	—

I must not conclude my notice of this Court without mentioning my indebtedness to Sir Samuel and Lady Davenport for their great courtesy

and kindness during the Exhibition, and the affability with which I was always received when making inquiries for this Report. The interest they take in silk culture is such that South Australia promises one day to be an important silk-producing Colony.

Whether all the circumstances which are favourable to such a consummation offer sufficient inducement to emigrants acquainted with sericiculture I am unable to decide, but I think the subject well worth consideration, especially as the objection which I heard put forward so frequently in 1878 at Paris, I have fortunately been able to meet. It was then said that although the climate and country were quite favourable to the culture of the silkworm, labour was scarce and too dear for its application to cocoon-reeling to be thought of. This objection also held good with regard to other parts of Australia.

Feeling this obstacle in itself to be insuperable, I set about casting for a remedy, and my visit to India supplied one, which was as follows:—Australia need not trouble itself with cocoon-reeling at all, but should export the cocoons as raw produce to the reeling districts of Bengal, where they can either be reeled by commission, or, what is better, bought outright. I found in Bengal a non-continuous state of silk-reeling owing to the bunds or cocoon harvests having their respective reeling seasons immediately following them, notably after the July or rainy bund, and the November, or cold-weather bund.

Briefly, the natives are only occupied six months in the year, and they would gladly welcome arrivals of cocoons from Australia, or other sources, to give them continuous employment.

I have it on the authority of the extensive firm of Messrs. Robert Watson and Co., through their agent and director Mr. Morey, who has the management and control of their numerous filatures in the Rajshahi district, where a considerable proportion of the population is employed in cocoon-reeling, that it would be a very great help indeed if they could be supplied with cocoons to keep their factories or filatures going all the year round, instead of about six months only out of the twelve as at present.

Mr. Morey informed me that importing cocoons from China could be made to pay, and that their factories could take *all the cocoons which the Colonies could produce for some time*, as the very best qualities of silk could be reeled from them.

As regards the value of cocoons reared in the Colonies, at the present prices of raw silk—Italian *22s. 6d.* per lb., China *15s. 6d.* per lb., Bengal *15s.* per lb., French *22s. 6d.* per lb., Japan *19s. 6d.* per lb.—it would not be less than *2s. 6d.* per lb. in the dried state.

The best arrangement would probably be to pay so much per lb. for the silk, allowing the reelers a fair profit; but, at any rate, there would always be a market for the cocoons, the chrysalides having been first killed, and the cocoons well dried before packing.

For two parcels of cocoons, which I have had to buy from Marseilles for the Royal Commission of the Colonial and Indian Exhibition, for the unbroken continuance of the cocoon-reeling in the Indian Silk Culture Court, I had to pay *5s.* per lb.

Silkworm eggs can be easily obtained from any of the countries the price of whose raw silk is above quoted.

The yield of raw silk from 1 lb. of cocoons is about 1½ oz.

I hope to be able shortly to comply with the request of Sir Samuel Davenport, that I should obtain for him an account of the best method of silkworm-rearing as practised in Italy and France.

QUEENSLAND.

The only silk specimens in the Court of this Colony were three samples of cocoons and skeins of raw silk reeled from cocoons.

Miss Gibson of Stanmore, Yatala, exhibited cocoons and skeins of raw silk. Catalogue, No. 116.

The Queensland Commissioners, Brisbane, exhibited cocoons and raw silk from the Bengal variety of silkworm, which had been reared in Upper Coomera by Mr. Edward Carrington. See Catalogue of Exhibits in Queensland Court, page 8, No. 117.

Mr. Liddle supplied me with cocoons from each of these exhibits and requested me to examine them. I had them reeled in the Exhibition by the Lyons woman who was brought over to illustrate the improved method of reeling Bengal and Tussur cocoons, and I reported to him as follows:—

"September 24th, 1886.

"DEAR MR. LIDDLE,

"I have reeled the enclosed samples of raw silk from the cocoons you sent me.

"No. 117. The cocoons reeled very well and the silk is of very good quality, Cocoons yellow and green.

"No. 117*a*. These cocoons did not reel so well as the former, being much too weak. The worms were either weak or badly fed, and the cocoons, though fit for spinning, were not so for reeling.

"No. 116. These cocoons reeled very well and the raw silk has a pleasant silky touch and is not hairy, but has a nice clean thread and is about the same as No. 117.

"Yours truly,

"(Signed) THOMAS WARDLE."

It is evident from this trial that Queensland is capable of sericiculture. The experiment with Bengal eggs was a somewhat hazardous one, because the Bengal worm is supposed to be of a different species from that of France, Italy, China and Japan, and better suited to the Bengal climate. It is, in fact, a species, or rather two species, peculiar to Bengal. See my account of them, pages 31, 41, &c., in the Descriptive Catalogue of the Indian Silk Culture Court, where it will be found that the two species are *Bombyx fortunatus* and *B. cræsi*, whilst that of the countries above-mentioned is *Bombyx mori*. I would strongly recommend the acclimatisation of the silkworms of these countries. Eggs can readily be obtained.

The climate of Queensland is stated to be hot and dry. I infer that the mulberry can grow, although it is not included in the list at page 12 of the Handbook on the Resources and Institutions of Queensland, amongst the plants that have become naturalised.

I would strongly urge the collection of larvæ, moths and cocoons of all indigenous and wild species of silk-producers, to be sent to me for examination as well as to form part of the forthcoming collection from all parts of the world at this year's Jubilee Exhibition at Manchester. The name of Mr. F. M. Bayley, of Brisbane, has been given to me as an entomologist to whom application could be made, and I would suggest that he be asked to obtain such a collection, and to make a continuous study of this subject, which may ultimately be of much economic value to Queensland, just as it is turning out to be for India, where wild silks are now beginning to be collected for export.

Mention is made in the above Handbook and in the Queensland Catalogue of good indigenous dyes. I shall be very happy to examine the tinctorial value and nature of any plants that the Commissioners may think fit to send to me, as well as any products valuable because they contain tannin.

WESTERN AUSTRALIA.

There were no exhibits of cocoons in the Court of this Colony.

But the experiment of silk-production has been tried in Western Australia so long ago as in 1878, when cocoons were sent over which had been produced by silkworms hatched, reared and fed on mulberry-trees grown in and about Perth. They were reeled in Lyons, and the raw silk produced from them was manufactured into beautiful satin, by Messrs. J. & T. Brocklehurst & Sons of Macclesfield, having been first dyed an excellent gold colour by the late eminent dyer, Mr. J. Barnet of Macclesfield.

The results of this experiment formed the only example of silk in this Court, and were exhibited in the shape of banner curtains made of the satin I have just described, and hung over the entrances of the New South Wales and Queensland Courts.

The quality of this satin left nothing to be desired; it was quite equal to that manufactured in Europe from the silk of any silk-producing country, and pointed to a good future when the population of this great part of Australia is sufficiently numerous to turn its attention to sericiculture.

I gather from the preface to the Catalogue of exhibits in the Western Australian Court, that the length of the Colony is 1280 miles, and its breadth, from east to west, 800 miles, a territory of about a million square miles, eleven times the extent of Great Britain, and forming one-third of the Continent of Australia, but possessing a population of only 40,000, leaving beyond the sea-board enormous undeveloped regions.

Western Australia is the only Crown Colony, all the officials being appointed in England.

I would strongly urge the continued search for, and collection of larvæ, moths and cocoons of all indigenous wild species of silk-producers which can be found in this Colony, as it is impossible to attach too much importance to the extension of sericicultural knowledge in this direction.

NEW ZEALAND.

I am informed by Sir Julius von Haast, K.C.M.G., Ph.D., the Commissioner in charge of the New Zealand exhibits, that no exhibits of silk, raw or manufactured, appeared in this Court.

It would be very desirable, I think, to give encouragement to sericiculture in New Zealand, under the new conditions which now make it more possible, I mean as to the consignment and facility of sale of cocoons to the Bengal silk-reelers.

I am informed that the mulberry grows in Auckland, and that there is no knowledge of any indigenous silk-producing insects in New Zealand. It is very probable that New Zealand may have a wild silk-producing fauna hitherto unobserved, and as the moths of most of the silkworms fly in the night time, none but entomologists would be likely to take the trouble to make inquiries and observations.

I would appeal to Professor Parker, of the Otago Museum, and T. F. Cheeseman, Esq., of the Auckland Museum, for information on this subject. The Natural History of this part of the world possessing such singular and unique interest, it is quite within the region of possibility that a thorough inquiry might result in information about silk-producing Lepidoptera of unique species, and in confirmation of this idea I noticed in the New Zealand Court a very curious caterpillar called the Vegetable Caterpillar of the Genus Hepialus, exhibited by Mr. Charles Sidey.

With a climate like that of New Zealand it is inconceivable at present what species of silk-producers may not be ultimately acclimatised.

FIJI.

There are two or three species of mulberry-trees in this island, and several species of silk-producing moths and spiders, but sericiculture has been abandoned owing to the ravages of ants and cockroaches.

CAPE OF GOOD HOPE.

The exhibits of silk produced in this Colony, I consider to be of very great interest and promise.

The cocoons appear to be good, and if native labour is obtainable at a sufficiently low rate, I do not see why the reeling of them could not be efficiently done. All depends on the price of such labour. If it is dear it is hopeless to attempt to compete with Italy, where the silk-reelers earn about 6*d.* per day, or in India where such labour can be had abundantly at 2*d.* to 4*d.* per day.]

In the Catalogue of Exhibits of the Cape of Good Hope, at page 43, will be found a list of the sericicultural experiments which have resulted in the silk exhibits of this Colony.

No. 102 is a specimen consisting of three ounces of raw silk, exhibited by Mr. H. D. Clarke of Graham's Town, but it has not been reeled with sufficiently good reeling appliances to make it good enough for the market.

No. 103 consists of specimens of cocoons and raw silk, also a brown silk handkerchief, woven at Macclesfield from similar cocoons to those exhibited, and a piece of chocolate-coloured faille, thickly ribbed and of very good quality and appearance. The exhibit is by Dr. J. M. Hiddingh of Newlands, a locality known as the Cape Peninsula. The raw silk is both white and yellow, according to the colour of the cocoons from which it has been reeled, which are the produce of silkworms fed on the white mulberry, (*Morus alba*), which no doubt thrives in the Cape.

No. 104 is an exhibit by Mr. E. W. Holdstock, consisting of yellow, white, and green cocoons with curious discs, also reeled silk. These cocoons were produced at Chalumna, a district of "East London."

No. 105 is an exhibit by Mr. G. H. Levey of Graham's Town, of twelve ounces of raw silk of native growth.

No. 106 is an exhibit by Mr. Valentine Roberts, of yellow cocoons and reeled silk, grown at Uitenhage, a locality which, he states, is well adapted for the cultivation of the mulberry tree. A gold medal was awarded to Mr. Roberts at the South African Exhibition, Port Elizabeth, in 1885, for superior quality of raw silk.

I ought to state here that the reeling of all the Colonial silks exhibited is of the most amateur and uncommercial description, and of no real trade value. The improvements which I have shown to the Indian silk reelers must be adopted so that a fixed number of cocoons can be reeled simultaneously with regularity in order to form a merchantable thread.

Miss C. B. Newdigate of Forest Hill, Knysna, exhibits twenty-four dessert d'oyleys made of hand-reeled raw silk.

There were three series of samples of raw silk exhibited, unnumbered, by Mr. Barrington of the Knysna District. He was also an exhibitor at the Paris Exhibition of 1878, and, I believe, obtained an award. I remember his exhibit, as I was on the Silk Jury of that Exhibition.

I hope Mr. R. Trimen, Curator of the Museum, Cape Town, will give me the advantage of his co-operation in obtaining examples of all the South African species of larvæ, cocoons and moths of silk-producers.

Probably no part of the world is richer in wild silk-producers, from those gregarious ones which feed and form their cocoons together in colonies some of which are upwards of a foot in length and consist of more than a hundred cocoons, enclosed in a silken bag, to those species which seriposit separately and alone.

It would be well if the Cape Town Museum were made a centre of collection of all the African silk-producers, accompanied in all possible cases with the cocoons they form, and so be made an aid, by supplying material, to the structural and other examinations of all kinds of silk fibre which I am conducting.

NATAL.

I have not been able to obtain much information about sericiculture in Natal.

From what I have read of the climate in the introductory chapter to the Catalogue of the Exhibits in the Natal Court, I think it is a highly suitable one for mulberry cultivation, and the rearing of mulberry-fed silkworms. The mean temperature of the summer at Pietermaritzburg is stated to be about 69°, and that of the winter 60°, that of the year being 64·7°. The temperature seldom descends to freezing point.

There were two exhibits of native-grown silk in the Natal Court—one by Mrs. H. J. Dodswell of Pietermaritzburg, consisting of cocoons, reeled silk, plaques and waste; and the other by Mrs. F. Hathorn, of the same place, consisting of a box of cocoons and two hanks of silk.

The fibre of these silks seemed to be all that could be desired, and the remarks I have made in writing of the Cape silks apply equally to those of Natal, especially with regard to collecting silk-producing Lepidoptera. There was a case of South African moths, suggestive of further and continuous collection.

The following are notes of my laboratory examinations of the cocoons exhibited by Mrs. H. J. Dodswell of Pietermaritzburg:—

Species of cocoon.—Mulberry-fed silkworm cocoon (*Bombyx ? mori*).

Description of the cocoon and its silk fibres.—Form: elliptical, but rather pointed at each end. Colour: bright yellow outside, pale yellow inside. Texture: not compact; the cocoon is easily separable into layers, and the outside is covered with a dense coating of very loose bright yellow fibre. Reeling: good, except that there was an excessive quantity of waste fibres on the surface of the cocoon. See the remarks about the bave under the head "Cocoon No. I.," New South Wales Report, which are applicable here also.

Weight of cocoon.—0·264 grammes.
Dimensions of cocoon.—37 × 14 millimetres.
Length of bave reeled.—236 metres.
Weight of bave reeled.—0·063 grammes.
Titre of bave, milligrammes per 500 metres.—133 milligrammes.
Titre of bave, in deniers.—2·50.
Mean diameter of bave.—0·0389 millimetres.
Mean elasticity of bave.—25·07 per cent.
Mean tenacity or strength of bave.—13·97 grammes.
Percentage of silk reeled from the cocoon.—23·86 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	405	390	372
Percentage of elasticity. Average of six estimations	28·8	28·7	17·7
Tenacity or breaking strength in grammes. Average of six estimations	15·6	14·4	11·9

	I.	II.	III.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon . . .	33	23	36 metres remained, weighing 7 milligrammes.

CEYLON.

Silk culture has been introduced into Ceylon by Mr. A. Ross of Matale, and I cannot do better than quote part of the description given at page 70 of the Official Handbook and Catalogue of the Ceylon Court, by way of prefacing my own observations. It is as follows:—"The white and yellowish-green cocoons shown are exhibited by Mr. Ross, who first imported 'seed' of the *Bombyx mori* from Japan, and endeavoured to rear the worms on his estate in the Matale district, a warm (average temperature about 75° Fahr.) and rather dry locality, about 1200 feet above sea-level. After a number of disappointments, the experiments gave some promise of success, and the silk pioneer, finding that in Matale *six* crops of silkworms could be reared within the year, *i.e.*, during the hot months of January, February, March, April, and part of May and August and September, set about planting mulberry cuttings along the roads and boundaries, with the view of taking up the industry. Four millions of eggs were obtained from Japan. The cocoons now exhibited are part of the result of this last attempt, and some of these have been favourably commended and valued both in Marseilles and Lyons. The mulberry cultivated is the common *Morus indica*, grown throughout Ceylon. On this the worms feed readily and thrive. It is grown in hedges and propagated by cuttings. The cultivation of the mulberry in the warmer parts of Ceylon, such as Matale Valley, at about 1200 feet altitude above sea-level, requires no attention beyond the putting down of the cuttings, and keeping them clear of jungle and weeds. The work of sericiculture is interesting and light; it could easily be managed by families of natives, many of whom have the mulberry growing about their homes and gardens, so that, with some inducement, which they always need in the introduction of new industries, there should be no reason why Ceylon, producing six crops of silk per annum, should not with this 'product' as with others, take the lead as to quantity and quality, and so tend to the raising of many natives of these dry districts from a state of indolence and want to one of comparative activity and well-being."

The cocoons obtained by Mr. Ross' experiments are of course those of the *Bombyx mori*, the silkworm which produces the ordinary silk of commerce.

The following are notes of my laboratory examinations of the two varieties of cocoons exhibited in the Ceylon Court by Mr. Ross, specimens of which were also sent by Mr. J. L. Shand of the Ceylon Court, to the Indian Silk Culture Court, where they were exhibited as Nos. 392*a* and 392*b*.

Cocoon No. I.

Species of cocoons, and district in which they were produced.—Mulberry-fed silkworm cocoons (*Bombyx mori*). From North Matale, Ceylon.

Description of cocoon and its silken fibre.—Form: elliptical-oblong, with medial depression. Colour: light yellowish-green. Texture: compact, but silken walls of cocoon thin. Reeling: good. See the remarks about the bave under the head of "Cocoon No. I.," New South Wales Report, which are applicable here also.

Weight of cocoon.—0·436 grammes.
Dimensions of cocoon.—28×16 millimetres.
Length of bave reeled.—472 metres.
Weight of bave reeled.—0·117 grammes.
Titre of bave, milligrammes per 500 metres.—124 milligrammes.
Titre of bave, in deniers.—2·33.
Mean diameter of bave.—0·0359 millimetres.
Mean elasticity of bave.—18·77 per cent.
Mean tenacity or strength of bave.—9·17 grammes.
Percentage of silk reeled from the cocoon.—26·84 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of the bave in ten-thousandths of a millimetre	385	395	298
Percentage of elasticity. Average of six estimations	22·3	24·0	10·0
Tenacity or breaking strength in grammes. Average of six estimations . . .	8·3	13·5	5·7

	I.	II.	III.	IV.	V.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	27	28	23	22	72 metres remained, weighing 17 milligrammes.

Cocoon No. II.

Species of cocoons, and district in which they were produced.—Mulberry-fed silkworm cocoons (*Bombyx mori*). From North Matale, Ceylon.

Description of cocoon and its silken fibre.—Form: elliptical-oblong, with medial depression. Colour: white inside and outside. Texture: fairly compact, but silken walls of cocoon separable into successive layers. Reeling: good. See the remarks about the bave under the head of "Cocoon No. I.," New South Wales Report, which are applicable here also.

Weight of cocoon.—0·397 grammes.
Dimensions of cocoon.—29×14 millimetres.
Length of bave reeled.—490 metres.
Weight of bave reeled.—0·145 grammes.
Titre of bave, milligrammes per 500 metres.—148 milligrammes.
Titre of bave, in deniers.—2·78.
Mean diameter of bave.—0·0364 millimetres.
Mean elasticity of bave.—20·00 per cent.
Mean tenacity or strength of bave.—10·5 grammes.
Percentage of silk reeled from the cocoon.—36·37 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of the bave in ten-thousandths of a millimetre	385	398	308
Percentage of elasticity. Average of six estimations	21·0	23·3	15·7
Tenacity or breaking strength in grammes. Average of six estimations . . .	8·6	12·2	10·7

	I.	II.	III.	IV.	V.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoons	37	34	30	24	90 metres remained, weighing 20 milligrammes.

There is no silk weaving in Ceylon.

THE STRAITS SETTLEMENTS.

I can find no trace of the existence of any sericicultural industry in this Colony.

There was exhibited in the Straits Settlements Court a collection of silk sarongs of interest, from Sumatra, made of silk from Siam. One was of a plaid pattern with representations of flowers printed upon it with gold, the borders having serrations like many of the fabrics of Java. There were also some with gold thread woven along with the silk.

Some of the silks were dyed in purple, blue and magenta, with aniline dyes.

There was also exhibited a case of Singapore sarongs and handkerchiefs.

I am without any information respecting silk-producing Lepidoptera in this Colony.

HONG KONG.

There was much of sericicultural interest in this Court, although cocoons were not shown.

The exhibits, however, may be said to illustrate the wealth of China in silk rather than of the small Colony of Hong Kong, where silk culture is

hardly practised, although much of China's silk is shipped from there. The exhibits thus represent the merchandise in silks and not their production, nevertheless it would be a serious omission if a description of them were not given.

First, as to entomology. There was a very fair and interesting collection, although much damaged in transit, of wild silk-producing moths, amongst which I noticed the Atlas moth (*Attacus atlas*) and the Eria moth (*Attacus ricini*), both so well-known in India, also the Chinese Tussur moth (*Antheræa pernyi*), and a few other species probably not yet named. These formed only a small part of a large collection of Chinese Lepidoptera, but suggested strongly the desirability of a careful systematic collection of all the silk-producers of China.

I strongly urge a two-fold collection: first, specimens of larvæ, moths and cocoons of *Bombyx mori* from all and every silkworm-rearing centre for the purpose of scientific comparison with those of France, Italy and other countries, and to help research with the view of improving the qualities of silk by breeding and crossing; second, a thorough search for the wild silk-producers and their cocoons, at present so little known, except the Chinese Tussur silkworm found in the North of China in abundance feeding on the oak. It was the cocoons of this species, which, owing to the greater quickness of the Chinese than the people of India, were collected and sent over to Europe to supply the demand for Indian Tussur at and subsequently to the Paris Exhibition of 1878. China has sustained her ascendency, unfortunately for India, up to the present time, and throughout the astonishing increase in the utilisation and consumption of Tussur silk, but India has at last awakened, and the two countries are on equal terms as to the supply effort.

A reeling factory has been established at Chefoo by Herr Otto Anz, and *pernyi* silk of very good quality is reeled there.

Too much emphasis cannot be given to my suggestion for exhaustive collections persistently sustained from time to time of wild silks, as although the cocoons of some species may not be reelable, all can be carded and spun, and there is not only a good European market for them, but a ready and eager demand.

The only illustrations of purely sericicultural work consisted of working models of reeling machines such as are used in China.

These machines were quite simple. There was a reeling table at which sat a figure of a Chinese reeler, and upon which was fixed an imitation of the basin in which the cocoons to be reeled are softened in water.

Behind the figure was a reel which, in one of the models was made to revolve by clockwork, and in another had to be turned by hand, and which drew the fibres or *baves* from the cocoons, winding them upon itself in skeins.

A very complete series of silks in the early stages of manipulation was contributed by Messrs. Arnhold, Karberg & Co., of Hong Kong, Canton, and of London. They comprised specimens of waste silk under the head of "Punjam," and a most interesting series of raw silks such as the European and other markets are supplied with. The following is the list of them in its completeness, which forms a most desirable addition to the published nomenclatures of silk:—

No.	——	——	Size in Deniers.	How produced from the Cocoon.
1	Punjam			
2	,,	waste silk	for spinners.	
3	,,			
4	,,			
50	Canton Tsatlee Curio		Loonkong.	
51	,, ,, No. 1		,,	
52	,, ,, Curio		Loongshan.	
53	,, ,, No. 1		,,	
54	,, ,, ,, 2		,,	
55	,, ,, ,, 1		Kodngon.	
56	,, ,, ,, 2		,,	
57	,, ,, ,, 2		Soeytang.	
58	,, ,, ,, 3		,,	
59	,, ,, ,, 4		,,	
60	,, Long Reels .		Lacklow.	
61	,, ,, ,,		Mahang.	
62	,, ,, ,,		Kowkong.	
100	Kwong Shun Cheong	. . .	13/15	Canton Steam.
101	Min King Lun .	. . .	14/16	Filature Silk.
102	Ü Han Cheong .	. . .	10/12	,,
103	Kai Cheong Loong .	. . .	10/12	,,
104	Yee Wo Cheong .	. . .	13/15	,,
105	,, ,, ,,	. . .	14/16	,,
106	Hing Loong Cheong	. . .	10/12	,,
108	Chong Kee . .	. . .	13/15	,,
109	Kwong Hing Lun .	. . .	10/12	,,
110	,, ,, ,,	. . .	10/12	Canton Steam.
111	Kam Lun Cheong .	. . .	13/15	Filature Silk.
112	Poo Cheong Woo .	. . .	13/15	,,
113	How King Cheong .	. . .	10/12	,,
120	Wing Wo Lun .	. . .	12/14	,,
118	King Wo Cheong .	. . .	18/22	,,
114	Wing Kee . .	. . .	10/12	,,
115	,, ,, . .	. . .	14/16	,,
116	Shun Po On . .	. . .	13/15	,,
117	Lee Han Sang .	. . .	10/12	,,
119	Ko King Lun. .	. . .	10/12	,,
121	Ohn Ching . .	. . .	10/12	,,
122	Sin Lun Cheong .	. . .	10/12	,,
123	King Cheong Loong	. . .	10/12	,,
124	Lee Ching Cheong .	. . .	11/13	,,
125	Yaen Hang Lee .	. . .	10/12	,,
126	Lun Kee . .	. . .	10/12	,,

The above examples with the reeling machine models have all been lent to the Royal Jubilee Exhibition at Manchester, of 1887, by Messrs. Arnhold, Karberg & Co.

The display of manufactured silks in the Hong Kong Court was of high interest, but the limited space at my disposal entirely prevents my doing them justice. I can only barely enumerate them.

In the selling bazaar dress silks of various kinds of Chinese manufacture found ready purchasers.

Of Crêpe, of excellent quality and style, were pieces, 20 yards in length, of various colours, of which the selling price was £4 10*s*.

Of Damasks there were pieces 15 yards in length and 21 inches wide, of thin stiff material, which were sold at £3 each.

Of Shantung silk, made from Chinese Tussur cocoons of the species which I have described, there were pieces in the undyed state, 19 inches wide, which were retailed at 1*s.* 6*d.* per yard. As in India, the application of colour to this silk still presents difficulties which the native dyers have not succeeded in overcoming, or at least only to a most limited extent. Happily the researches which I have had the honour of conducting for some years past for the Government of India have resulted in the total overcoming of these difficulties, alike with the indigenous natural dyes of the East and the modern artificial dyes of Europe, as well also in the successful bleaching of this silk; and there is now no reason why Tussur silks, manufactured from either the Indian or the Chinese species, should not receive decorative tinctorial treatment by both dyeing and printing, in a similar degree to the ordinary silks of commerce. The future of the Tussur silk industry is a very great and promising one, and too much attention cannot be given to the production of the raw material.

Of embroideries the Court contained a collection well illustrating this mode of Chinese decoration. Some pieces were very valuable and in perfect taste as to colour, whilst as to design there was everything to illustrate the strange fantasies of Chinese treatment.

Mr. J. Whittall, of Hong Kong, lent a very large piece of embroidery on a red ground. The colours were produced by native dyes, and were of good tone.

There were loans of embroidered screens and portières.

Messrs. Stolterforth and Hirst, of Hong Kong, exhibited an interesting case of silk handkerchiefs.

But the principal decorative feature of this Court was a very large piece of embroidery of most exquisite treatment placed at the north end of the Court. It is a magnificent embroidered scroll,* presented by the Chinese merchants of Hong Kong to His Royal Highness the Prince of Wales, President of the Colonial and Indian Exhibition, in testimony of their loyalty and appreciation of British rule in Hong Kong.

Its merits quite constituted its claim to be considered one of the most important pieces of art work in last year's Exhibition, and it was a model of beautiful, thoughtful, and patient work, deserving the close attention of all ladies interested in reforming the low state into which the art of embroidery has fallen in England in this century.

I must not omit the mention of a collection of silken stuffs lent by Lady Bowen, the wife of Sir George F. Bowen, the present Governor of Hong Kong. I offered to insert a short description of them if Lady Bowen would furnish me with it, but as I have heard nothing from the gentleman who promised to communicate with her, I assume that it was not thought necessary. The collection consisted of old silks, both pattern-woven and embroidered. One of the principal merits of these silks was the absence of artificial dyes, and the conspicuous success of the employment of indigo for the blues as well as excellent colours in red and green.

This collection possessed high interest for all those who delight in the peculiar forms of Chinese decoration. In colour treatment many of the fabrics were good models for any school or style.

My acknowledgments are due to H. E. Wodehouse, Esq., C.M.G., Special Commissioner for Hong Kong, and to the Assistant Commissioner,

* "Illustrated Naval and Military Magazine," p. 347.

E. H. Fishbourne, Esq., LL.B., M.A., for much attention during numerous visits of inspection which I found it necessary to make to this Court.

I formally applied to these gentlemen for a collection of larvæ, moths, and cocoons from China for the Royal Jubilee Exhibition at Manchester, where such a collection will meet with perhaps more appreciation than in London, Manchester being in the centre of the districts where both reeled and spun silk fabrics and threads are manufactured.

BRITISH NORTH BORNEO.

There is no silk culture in this tropical Colony.

There were some interesting exhibits of sarongs in the Borneo Court. Kinkhab sarongs are woven in Borneo. Chinese silk is used, and it is interwoven with gold thread, the effects produced being mostly gold on yellow, crimson, or green.

The curious bandhana or "tye-and-dye" work of India is also done here in zigzag spots.

The silk yarns for the warp and weft of the fabrics woven in Borneo are purchased from China ready dyed.

There were also exhibited in this Court good examples of native woven silk and cotton sarongs, in silk of bright colours on orange-coloured cotton ground.

No collection of silk-producing Lepidoptera were sent, and I hope to learn what wild silk-producers Borneo contains.

BRITISH GUIANA.

I am indebted to the courtesy of the Executive Commissioner for this Colony, G. H. Hawtayne, Esq., C.M.G., for the following information :—

Nothing is known of any silk produced by indigenous or imported Lepidoptera, and no silk industry is carried on in this Colony, but there are moths much like the Atlas moth of India, but smaller. Mr. Hawtayne has kindly promised to obtain some for me, with their larvæ and cocoons if possible; also any other species which may exist in British Guiana, with the plants on which they feed.

The rate of female labour in British Guiana is 1*s.* to 1*s.* 4*d.* per day.

THE WEST INDIES.

The West Indies and British Honduras, comprising Jamaica, Trinidad, Barbados, Grenada, St. Vincent, Tobago, St. Lucia, Antigua, St. Christopher, Dominica, Montserrat, Virgin Islands, British Honduras, and the Bahamas, furnish but little of sericicultural interest.

In the cases of Lepidoptera exhibited in these Courts I noticed several species of silk-producers, from which I infer that a proper search made throughout these islands and districts might result in a good addition to our sericicultural and lepidopterous knowledge.

In the British Honduras Court, Sir Augustus Adderley drew my attention to a bunch of fawn-coloured substance of fibrous structure, $5\frac{3}{4}$ inches long, $3\frac{1}{4}$ inches wide, and $1\frac{1}{2}$ inches thick, which, on closer examination, I found to be a cluster of silk cocoons containing living chrysalides, and during the summer (1886) a moth emerged from each of four of the cocoons. Each cocoon is about $1\frac{3}{8}$ inches in length, and $\frac{5}{8}$ inch in width.

This is most probably a new species, and belongs to the family—Lasiocampidæ; Genus, Hyleora.

The four moths which emerged from these cocoons were all females. The fore wings mottled pale-brown, without very distinctive markings or eye-spots. The hind wings were like the fore wings in appearance. Measurement across the wings $2\frac{2}{18}$ inches.

The silk differs from most wild silks, inasmuch as the fibre is round and resembles in structure and form that of the cocoons of the mulberry-feeding species, which produce the ordinary silk of commerce. Its diameter, however, is less, that of the double fibre being only $\frac{1}{1270}$ inch, and of the single fibre $\frac{1}{2540}$ inch. The fibres are deposited in pairs in the cocoons by the silkworm like those of all other silks, and are very uniform in diameter.

This new silk is very interesting both to sericiculture and to science, and I would suggest that further investigations should be made in Honduras, and the cocoons, if they should be found in quantity, sent over to England for spinning purposes.

The cocoons are bound together in a cluster or bunch by silk fibre, and are enclosed in a thin transparent bag which is a web or tissue of the same material.

WEST AFRICA SETTLEMENTS.

Captain Moloney, C.M.G., late Governor of Gambia, exhibited a beautifully arranged series of insect cases amongst which were fourteen cases of moths containing, with others, several species of silk-producers.

There is no silk industry in these Colonies as far as I can learn.

I was most obligingly shown over this most interesting Court by Sir James Marshall, C.M.G., the Executive Commissioner, who gave me specimens of several dyes which I promised him I would examine.

MALTA.

The Maltese Court contained some very interesting applications of silk.

There were some excellent examples of embroidery, for the most part for church purposes, such as sacred vestments and for covering church furniture and vessels. There are about eighty women engaged in this occupation, and there were seven exhibits of embroidery in gold for these purposes, as well as four in silk for secular uses, besides handkerchiefs and tapestry.

But the most interesting silk productions were the Maltese lace exhibits of which there were very beautiful illustrations both ancient and modern. Upwards of fifty contributors of lace handkerchiefs, scarves, lace for trimming dresses, collars, cuffs, fichus, chair covers, albs, dress pieces, counterpanes, shawls, neckties, antimacassars, &c., helped to make this Court very attractive.

Maltese lace is both black and white, or rather creamy-white. The silk from which it is made is a thickish two-fold thread, rather flossy in its manufacture, and is used in the boiled-off state and tinged a full creamy colour where not dyed black.

Malta is also noted for its Balla lace, an old Maltese point lace worked by amateurs for ecclesiastical purposes, chiefly for albs. It is made of linen thread.

There is no sericicultural industry in this island, it appearing to have been abandoned many years ago, nor is the mulberry tree cultivated. I do not know of any reason to prevent silkworm rearing being commenced, either climatic or otherwise. It flourishes well in Cyprus, and I think might be made to do so in Malta.

In the Handbook of Malta, published by the Commissioners, it is erroneously stated that silk is there produced by a wild shrub, and also that the branches of the mulberry furnish "a coarse outside of silk without the work of the silkworm." This, however, is evidently an error.

Between 4000 and 5000 women and girls are employed in Malta in the lace industry, "whose work yields to the island an annual income of £45,000 to £50,000." It is principally made in Gozo, where both black and white silk lace are worked by women with many threads on cushions fixed in front of them.

At the stall held by Mr. Michael Borg in the Maltese Court were some exquisite specimens of collars, cuffs, head pieces, &c., at very reasonable prices. The Maltese Cross appears to be a favourite form of ornamentation. The silk thread is obtained from England, where it is manufactured.

Some beautiful photographs of this lace were made by Messrs. Downey.

So successful has been its introduction to the public that Mr. Borg is again exhibiting it at the Queen's Jubilee Exhibition at Manchester in 1887.

Female labour is paid for at the rate of 1*s.* 3*d.* per day. A working artisan earns 2*s.* to 2*s.* 6*d.* per day.

CYPRUS.

Cyprus has for a long period been a silk-producing island. The climate is on the whole salubrious, especially in the higher plateaux, being hot in summer and moderate in winter.

The cocoons produced here are the largest I have seen. The silk of those of Baffo (the ancient Paphos), has the reputation of being stronger than the silks of Asia Minor or Western Europe, and has been for many years used in France in the manufacture of gold and silver lace.

Many of the cocoons I have seen are much pointed at one end and rounded at the other. The largest measure 2 inches in length and $\frac{7}{8}$ inch in breadth; 6 to 6½ lbs. of them are stated to produce 1 lb. of silk, which is a large yield.

Disease of the silkworms has injured this industry, but no doubt careful attention to its causes and nature would show it to be preventable or at any rate curable; and I would especially recommend the encouragement of silk culture to those in authority.

There is no need to provide for reeling the cocoons, because the filatures of Italy and France are so near, and there is no difficulty in disposing of the silk in the cocoon state. This ought to be made a very important industry, and it would, as formerly, be a profitable means of subsistence to the Cyprian women.

There were three exhibits of cocoons in the Cyprus Court, one being from Cypriote eggs, one from Japanese and one from French eggs. The yield in Cyprus from the two latter was stated to me to be 1 lb. of silk from 12 to 13 lbs. of cocoons.

In the Court was a silk loom at which a Cypriote woman was weaving silken cloth called *Metaxota*, a striped silk, the stripes being formed by using gum silk warp, *i.e.*, silk with its natural gum undischarged, for the transparent stripes, and discharged or boiled-off silk in double quantity for the opaque stripes. The weft is boiled-off tram. Both warp and weft are undyed, and are called respectively *Thiasma* and *Exesma*.

There was a native cocoon reeling apparatus of very rude and cumbrous description. If silk reeling is to succeed in Cyprus, recourse must be had to the later and more perfect machinery of Italy and France, as also for twisting or throwing purposes for the manufacture of silk for native use.

There would be ample demand for any quantity of cocoons, or of raw silk, the island could be made to yield, as the fibre of the silk enjoys such a good reputation.

I especially emphasise the capabilities of this island, with its favourable climatic conditions, and its hills and plains, as a silk-producing region, especially as it is now under British control.

Good crêpe is made in Cyprus, and head-dress handkerchiefs, called cumerbunds, embroidered in silk with flowers of a very naturalistic appearance, are worn of it.

The Cypriotes are clever flower-modellers in silk, which work they do in Rhodian-like stitch or plait.

They also weave shot silks made with a dyed and stiffened warp, in black, gold, blue, violet or red, with a tram weft of undyed boiled-off silk.

Native or Eastern dyes appear to have been supplanted by European artificial dyes.

The following are notes of my laboratory examinations of the mulberry-fed silkworm (*Bombyx mori*) cocoons from Cyprus exhibited in the Indian Silk Culture Court, No. 248:—

Description of the cocoon and its silk fibre.—Form: elliptical-oblong, but pointed at one end, and with a slight medial depression. Colour: light buff outside and inside. Texture: compact, but silken walls of cocoon thin. Reeling: good. See the remarks about the bave under the head "Cocoon No. I.," New South Wales Report, which are applicable here also.

Weight of cocoon—0·653 grammes.
Dimensions of cocoon.—47 × 20 millimetres.
Length of bave reeled.—787 metres.
Weight of bave reeled.—0·234 grammes.
Titre of bave, milligrammes per 500 metres.—149 milligrammes.
Titre of bave in deniers.—2·80.
Mean diameter of bave.—0·0375 millimetres.
Mean elasticity of bave.—23·2 per cent.
Mean tenacity or strength of bave.—14·1 grammes.
Percentage of silk reeled from the cocoon.—35·83 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	310	479	335
Percentage of elasticity. Average of six estimations	16·1	29·4	24·1
Tenacity or breaking strength in grammes. Average of six estimations	11·1	17·2	14·1

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	41	41	37	34	29	25	19	87 metres remained, weighing 8 milligrammes.

In order to make the value of the estimations of thickness, elasticity and tenacity or strength of the several specimens of silk examined in the foregoing pages more apparent, it is necessary to compare them with silks of known commercial worth; and I therefore add the results of similar examinations of typical cocoons from France, Japan, and Bengal, at the same time stating their respective present values in the market as raw silk, which are as follows:—French, 22*s.* per lb.; Japanese, 18*s.* per lb.; Bengal, 18*s.* per lb.; and Italian, 22*s.* per lb.

French Cocoon.

Description of the cocoon and its silk fibre.—Form: elliptical-oblong, with slight medial depression. Colour: light buff outside, yellow inside. Texture: compact, but silken walls of cocoon separable into successive layers. Reeling: good. See the remarks about the bave under the head "Cocoon No. I.," New South Wales Report, which are applicable here also.

Weight of cocoon.—0·565 grammes.
Dimensions of cocoon.—31 × 17 millimetres.
Length of bave reeled.—705 metres.
Weight of bave reeled.—0·197 grammes.
Titre of bave, milligrammes per 500 metres.—140 mill grammes.
Titre of bave, in deniers.—2·63.
Mean diameter of bave.—0·0334 millimetres.
Mean elasticity of bave.—19·30 per cent.
Mean tenacity or strength of bave.—9·50 grammes.
Percentage of silk reeled from the cocoon.—34·87 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	330	347	325
Percentage of elasticity. Average of six estimations	14·4	23·8	19·7
Tenacity or breaking strength in grammes. Average of six estimations	7·9	12·4	8·2

	I.	II.	III.	IV.	V.	VI.	VII.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon	28	34	33	32	27	24	18

The following particulars regarding a French cocoon will show the relative proportions in weight of the bave, the waste fibres, and the chrysalis. The different parts of the cocoon were of course weighed in a dry state:—

Weight of cocoon	0·711 grammes.
,, ,, chrysalis	0·432 ,,
,, ,, bave	0·246 ,,
,, ,, waste fibres, including the superficial waste and the unreelable fibres surrounding the chrysalis, which form an envelope called in France the "telette"	0·033 ,,

Bengal Cocoon.

Description of the cocoon and of its silk fibre.—Form: elliptical-oblong, without medial depression. Colour: deep golden yellow outside and lighter yellow inside. Texture: not very compact, the silken wall of the cocoon being separable into successive layers, and its surface being covered by many loose waste fibres. Reeling: good. See the remarks about the bave under the head "Cocoon No. I.," New South Wales Report, which are applicable here also.
Weight of cocoon.—0·184 grammes.
Dimensions of cocoon.—26 × 14 millimetres.
Length of bave reeled.—104 metres.
Weight of bave reeled.—0·022 grammes.
Titre of bave, milligrammes per 500 metres.—105 milligrammes.
Titre of bave, in deniers.—1·97.
Mean diameter of bave.—0·0203 millimetres.

Mean elasticity of bave.—17·87 per cent.
Mean tenacity or strength of bave.—9·33 grammes.
Percentage of silk reeled from the cocoon.—11·95 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	205	212	190
Percentage of elasticity. Average of six estimations	20·7	20·5	12·4
Tenacity or breaking strength in grammes. Average of six estimations . . .	10·2	10·7	7·1

Japanese Cocoon (*Ao Jiku*).

Description of the cocoon and its silk fibre.—Form: elliptical-oblong, with medial depression. Colour: white inside and outside. Texture: compact, but silken walls of cocoon separable into successive layers. Reeling: good. See the remarks about the bave under the head "Cocoon No. I.," New South Wales Report, which are applicable here also.
Weight of cocoon.—0·730 grammes.
Dimensions of cocoon.—33 × 16 millimetres.
Length of bave reeled.—642 metres.
Weight of bave reeled.—0·276 grammes.
Titre of bave, milligrammes per 500 metres.—215 milligrammes.
Titre of bave in deniers.—4·00.
Mean diameter of bave.—0·0393 millimetres.
Mean elasticity of bave.—14·33 per cent.
Mean tenacity or strength of bave.—9·50 grammes.
Percentage of silk reeled from the cocoon.—37·81 per cent.

Diameter, elasticity and tenacity of the bave—(I.) 10 metres from the end at the outside of the cocoon; (II.) at the middle of the cocoon; and (III.) 10 metres from the end at the inside of the cocoon.

	I.	II.	III.
Diameter of bave in ten-thousandths of a millimetre	375	412	392
Percentage of elasticity. Average of six estimations	11·7	18·9	12·4
Tenacity or breaking strength in grammes. Average of six estimations . . .	7·9	12·4	8·2

	I.	II.	III.	IV.	V.	VI.	VII.
Weight in milligrammes of each 100 metres of bave reeled from the cocoon, commencing at the end of the bave which is at the outside of the cocoon . .	34	42	44	48	46	44	42 metres remained, weighing 18 milligrammes.

Monsieur Rondot, who is author of "L'Art de la Soie" and several other works on silk, and Président de la Section des Industries Textiles à la Commission Permanente des Valeurs de Douane, and to whom I wrote for information as to books and about sericiculture, replied to me as follows :—

"I assure you that I do not know whether there exists a treatise on the rearing of silkworms. I do not believe there does. The method of raising them has been so changed since the epidemic that the old treatises are of no use.

"At the present time, in France and in Italy, the processes of rearing are conducted according to the races which are being reared, and the quantity of leaves, the temperature of the silkworm nurseries, &c., are regulated according to the climate, the mulberry trees, the varieties, &c. The old mode of rearing silkworms, carried on rather at random, is abandoned, and microscopes are found in the possession of almost all our peasants.

"If I may judge from the cocoons and silks of Australia which I have examined, and I have moreover received some recently, eggs of degenerate worms, which appear to be of Italian origin, are put for hatching in that country.

"If sericiculture is to be advanced in Australia, living eggs and cocoons should first be sent there; and sericiculturists, on examining them, would be able to say what effect the climate, the soil, and the temperature might have upon the insect in Australia. It would be possible then to recommend the introduction of the most suitable varieties, and the most likely ones for giving products satisfactory in quality and sufficient in quantity.

"The rearing of silkworms so as to give good results requires much experience, as also the use of healthy and selected eggs.

"All the world knows how to rear silkworms, and children rear them in almost all the schools in France, but in order that such work may be profitable it is necessary, I repeat, to know perfectly the locality, the soil, and the species of mulberry, and to be quite sure as to the state of the eggs placed for hatching.

"I have at this moment close by me, whilst I am writing, one of the first sericiculturists in Italy, whom I have asked what reply I ought to give to you, and he has told me this :—'In all the manuals, old or new, it is told how the silkworm is reared. What is not found in any book is how the processes of rearing vary according to country, locality, and the eggs employed, and how, at the present day, all depends upon the eggs and the variety.'

"I add this : — They know quite well how to rear silkworms in Australia. The people of that country have nothing to learn in this regard. That which they appear to be completely ignorant of is the work done in France and in Italy with regard to the varieties and the eggs.

"It is quite useless that they should know this, for sericiculture is in its infancy with them, and as a practical solution of the difficulty the only thing to do is to send living eggs and cocoons, and then, after examination, sericiculturists should indicate what eggs can be introduced into Australia with any chance of success."

I may add that I should be glad to be of any assistance in this matter, and to forward, through M. Rondot, to the French serici-

culturists any inquiries from any of our Colonies, whether they are for various races or varieties of living eggs and cocoons to be sent out to the Colonies for the sericiculturists there to experiment with, with a view of ascertaining their suitability to each climate and country, or whether the Colonial sericiculturists may be desirous of having their eggs, cocoons, larvæ, or moths examined by the French sericiculturists, who no doubt could give valuable information both in detecting disease and in stating which varieties would be probable to repay efforts of culture. Such examinations in France, where the silkworm is reared with the most advanced refinements, would form a valuable supplement to my own researches on the physical properties of the silken fibre of the cocoons of the various races of worms.

In order to facilitate the collection and examination of all kinds of cocoons, I append a copy of a letter I have addressed to various parts of the world, together with directions for collecting sericicultural objects. I shall be glad to receive whatever entomological and sericicultural assistance the readers of this report may be able or inclined to give.

The CATERPILLARS or WORMS should be collected when full-grown, and whilst alive put into a bottle of spirits (gin, or common white spirit of the country). When dead they should be taken out, those of each kind kept separate, and then be labelled with a number (as 1, 2, 3, &c.) written *in pencil* on white paper, or scratched on a piece of tin. Several specimens of each kind, with its numbered label, to be wrapped together in a cotton rag and loosely tied up with cotton thread or thin string, and again placed in the bottle (a good, stout pickle bottle, with wide mouth, is best, and easily obtainable), filling up the bottle with spirit and corking it tightly.

The COCOONS, in good condition, to be placed together in small batches, labelled with the same number as that on the worms which produce them. The batches should then be wrapped in coarse cotton rag and marked with the number on label, and tied outside.

The MOTHS to be collected in perfect condition, killed with care, so as not to rub or break the wings. Before they get dry and brittle the wings to be placed over the back, with the underside lying flat and uppermost. Each specimen, when dry, to be placed in a folded paper envelope, and labelled on the outside with the same number as on the worm and cocoon of the kind to which it refers. These moths in the envelopes to be placed in a small square box (a cigar box if obtainable), and gummed paper fixed round the edges.

The bottles should be wrapped in some soft wool, cotton, or other fibre, to keep them from being broken. The bottles, batches of cocoons, and boxes containing the moths, to be packed in a larger box for despatch to England.

Descriptive notes on the food plants, times of appearance, number of broods in the year, and any other useful information should be sent home with each box.

MISCELLANEOUS FIBRES.

By C. F. Cross.

In presenting my report upon the "Miscellaneous" fibrous raw materials in the Exhibition, I shall keep as far as possible within the limits prescribed by its more immediate scope and purpose, which I take to be the promotion of Industry and Commerce. At the same time, in deference to the universal experience that the extension and improvement of our commercial industries is ever making greater and greater demands upon the resources of investigators, and that empiricism as a guide to development must give way, more and more, to the methods of science, I shall endeavour to keep in view so much of the first principles of the subject as is necessary to the formation of the scientific judgment in regard to our raw materials, and to show that in this judgment is contained the solution of the more practical questions of their commercial application. It is the more necessary to do this, since this department of industry has been perhaps exceptionally fruitful of baseless enterprise—of abortive attempts to make into commercial undertakings that which careful antecedent investigation would have consigned to the long list of the unprofitable. Further: these Exhibitions serve as landmarks of progress in industrial science, and their literary records, written to the furtherance of this important end, are of especial value to technical and scientific men. As a precedent for the scientific treatment of our subject, I may cite Dr. Hugo Müller's report to the Vienna Exhibition (1873) upon the subject of Vegetable Fibres, a report which has contributed in no small degree to the spread of sound views concerning their chemical nature, treatment, and applications, and would have done more, but for the circumstances of its publication, which render it somewhat inaccessible to the English reader. This is only one of a large number of treatises which have been written during the last twenty-five years, most of which aim at industrial developments, at the same time basing their treatment of the subject upon scientific considerations, more or less. It is nevertheless true that these efforts have not borne much fruit in extending our commerce in fibres, and that the number of fibres which we may regard as constituting the staple of our textile industries remains very much within the familiar limited range. There arises consequently the very pertinent enquiry: Is there any necessity in the nature of things for an extended application of the multitudinous Vegetable Fibres? Are not those fibres, now in possession, sufficient not only in supply but in kind, *i.e.* in variety, for all the possible purposes of vegetable textiles? Supposing the supply insufficient, are we not rather to seek the remedy in improved methods of producing and treating our present raw materials, than in introducing new ones? especially since a new fibre means new methods and machinery for the agriculturists and spinners.

It is to questions of this kind that Science can give direct answers, and

I think it necessary to give some indications of the method pursued by the investigator in answer to such enquiries. It is not my intention to deal critically with the methods of the several investigators in this field, beyond pointing out that while sound in themselves, they are for the most part either chemical or microscopic, and their results therefore require complementary interpretation. For the rest, my criticism will be limited to the selection of the best from amongst these methods. The purpose in view being to widen the common ground between scientific and practical men in a great department of industry, I may, in elucidating the common method of investigation, ask for the indulgence of either if I have to traverse familiar ground. If at the same time new points of attack should be revealed to those who are busy in wresting Nature's secrets, the writer will have the additional satisfaction of helping as a fellow pioneer.

It is well known that the Vegetable Fibres group themselves industrially, according to their applications; and it is also well known and interesting to note, that the grouping follows very much the classifications which we call physiological. Thus cotton as a seed hair is distinct, consisting as it does of independent ultimate cells: the Miscellaneous Fibres, on the other hand, with which we have to do—a class which includes all other fibrous raw materials—are, in contradistinction, fibre-aggregates. The conditions of this aggregation are various. The ultimate fibre being a hollow tube with more or less thickened walls, and of comparatively short length ($\frac{1}{25}$ inch–2 inches), these are built up together into a compound fibre: (1) by apposition merely; (2) by a stronger adhesion determined by a species of fusion of contiguous cell walls; (3) sometimes by, what may in such case be properly termed, incrustation, *i.e.* a cementing together through the intervention of a third substance. This encrusting substance may be cellular, in that case the whole aggregate is or was an integral part of the living skeleton of the plant; or the incrustation may be due to amorphous substances, such as gums, which are rather products of degradation, or excreta, than concerned in the general functions of the plant. (4) In certain cases, by reason of the preponderance of fibre or elongated cells, the whole of a plant comes to be regarded as a fibrous raw material, and is treated in the arts as such, *e.g.* Esparto, and the straw of cereals. In these the fibre aggregation, being organic, is usually of such a character as to require a chemical process of disaggregation to bring it into evidence. Raw materials of this kind are used either for paper-making, or for the very coarsest textiles, *e.g.* mats.

Though the union of the fibre into bundles or complexes is resolved to a greater or less extent by the processes of separation and preparation for spinning, the spinning processes adopted require a unit of length such as can only be given by a fibre bundle, as described above. To this spinning unit it is convenient to give the term "filament," as distinguished from the ultimate fibres, or fibre cells, of which it is built up. Given the filament, and confining our attention for the present to mechanical or structural points, the value of a raw material will depend upon the length, together with the relative fineness or degree of divisibility of the fibre-bundles. The value of a yarn or fabric depends upon its strength and durability; and these qualities in turn upon the ultimate composition, structural as well as chemical. These are expressed by experimental numbers, the results of investigation, and are what we may term the

constants of the fibre; they are determinable by laboratory investigation, with the precision which necessarily attaches to scientific measurements. First: in regard to the form or structure of the ultimate fibre. What we may call the universal element is the typical Bast fibre of Vegetable Physiology; a fusiform tubulated, elongated, thick-walled cell. These cells vary but little in diameter from plant to plant ($\frac{1}{100}$ mm.), but on the other hand considerably in length. Comparing flax (25–40 mm.) with jute (1–3 mm.), for instance, the disproportion is very great; and, as we shall see, a considerable factor of the difference of value of the fibres. Secondly: in regard to the composition of the fibre substances, *i.e.* the chemistry of the raw materials. The fibre constituents, while they resemble one another generally in composition and properties, nevertheless exhibit certain striking distinctions. All the raw fibres are made up of a portion which yields readily to the action of oxidising agents and alkaline solvents—which are in effect the agents universally employed in bleaching the vegetable fibres—and a more resistant portion which does not yield. This latter is the cellulose basis of the fibres. The isolation of cellulose is therefore to the chemist what bleaching is to the textile manufacturer. If the operation be followed, in regard to its influence upon structure, with the aid of the microscope, it will be found to be attended by a disintegration, more or less, of the filaments, *i.e.*, that the cellulose obtained consists of the ultimate fibres or fibre-cells. It is the length of these individual cells, together with their proportion in aggregate weight to the raw fibre, which are the primary constants of the fibre. The common chemical feature of the vegetable fibres is, therefore, that when treated exhaustively with oxidising agents and alkaline solvents, they yield a white lustrous residue of cellulose; while on the other hand this constitutes a proportion in weight varying from fibre to fibre, and is made up of ultimate fibre cells varying considerably in length from fibre to fibre.

The following are the constants for the more important textile fibres:—

	Percentage of Cellulose.	Length of ultimate fibre.
Flax	80·0	25–40 mm.
Hemp	80·0	25–40 ,,
Rhea	75·0	60–200 ,,
Jute	75·0	3 ,,

The above fibres are physiologically identical: they are the bast tissues of dicotyledonous annuals. The filaments are bundles of from three to fifteen fibres, as seen in sections at any point, more or less compactly welded together.

The second of the greater divisions of the Vegetable Fibres includes the fibre bundles of the monocotyledons, which furnish a large proportion of the raw materials for the rope-making industry. In these the filament is not only a much larger aggregate, and therefore coarser, but is in many cases more complex in structure. In place of a homogeneous bundle of bast fibres, we have bast fibres and vessels, cemented together and often enclosed in a cellular sheath. The bundles, moreover, as seen in section under the microscope, exhibit considerable variations from the cylindrical, which is characteristic of bast filaments; thus in the aloe fibre the crescent form prevails. The bundles, though containing other structural elements, are, however, for the most part made up of the typical bast fibre, of which we can often count as many as 50–100 in the section. The dimensions of

these fibres, as well as the percentage of cellulose in the filaments of the more important in this class, are given below :—

	Percentage of Cellulose.	Length of ultimate fibre.
Manilla	63·0	3–6 mm.
Phormium	67·0	8–15 ,,
Agave	76·0	2–8 ,,

So far we have taken the raw fibres as made up of cellulose and non-cellulose, the latter yielding more or less readily to the action of oxidising agents and alkaline solvents. The non-cellulose, unlike the cellulose, is a very characteristic constituent, in the sense that the raw fibres divide themselves into two well-marked groups, according to its composition, viz. : (1) the pectic; (2) the lignified. In addition to their being sharply distinguished by their reactions, the union with the cellulose is much more intimate in (2); so that whereas boiling with alkaline solutions suffices to hydrolyse and dissolve away the pectic portion of the *pecto-celluloses*, the *ligno-celluloses* are not so resolved; in this and in many other respects they have more the chemical characteristics of a homogeneous body. The distinguishing characteristics of the ligno-celluloses are (*a*) direct combination with chlorine, the chlorinates giving an intense coloration (magenta) with solution of sodium sulphite; (*b*) a bright yellow colour-reaction with solutions of the aniline salts; (*c*) a deep purple with phloroglucol in presence of hydrochloric acid (conc); (*d*) conversion into an orange-coloured nitrate, on treatment with a mixture of nitric and sulphuric acids.

Of the above-mentioned fibres, flax, hemp and rhea belong to the first group, jute to the second, while the monocotyledonous fibres, as might be expected from their more complex character, manifest the properties of both groups.

The pectic fibres, as a class, are superior to the lignified in respect of softness and divisibility of the filaments. Moreover, it is remarkable that the characteristics of the latter group are always correlated with shortness of ultimate fibre; they are also generally inferior in regard to proportion of cellulose. We are now, therefore, in possession of the equivalents, in science, of the inferior position which they occupy in commerce and the arts. Generally, moreover, we find that our constants and the inferences to be drawn from them lead to a classification of the fibres, which is in most respects an endorsement of long-established usage, and we have, therefore, the more confidence that the application of these criteria to new and hitherto undeveloped raw materials will enable us to form certain conclusions as to their value.

We turn from the textile fibres to consider briefly the third and fourth divisions of vegetable fibrous substances—those which are so constituted as to be unavailable for the textile manufacture, and which can only be made available for paper-making through a process of chemical disintegration. Those of monocotyledonous origin employed for this purpose are entire stems or leaves (Bamboo, Straw, Esparto). By the preliminary boiling process, usually at high temperatures, *i.e.* under pressure, the structures are so far resolved that the separation into cellular and fibrous portions is only a matter of breaking and washing. The resolution is completed by the bleaching operation, by which the residues of "encrusting and intercellular matters" are oxidised and dissolved away, leaving a disintegrated mass of ultimate fibres, and as regards chemical composition, a pure cellulose. Of

bast tissues (dicotyledonous) very few are worked on this plan, the consumption in European manufactures being virtually limited to jute "cuttings," and the Adansonia fibre, the bast of the Monkey-bread Tree, which is imported from West Africa. These, moreover, are used in the manufacture of wrapping papers, and not as a cellulose or bleached fibre. The woods of the coniferous species, Abies and Pinus, are, on the other hand, largely used in paper-making, both as mechanical pulp, obtained by simply grinding the wood to a fibrous mass, or by chemical processes of resolution of various kinds which reduce the wood structures to a mass of ultimate fibres easily brought by bleaching agents to the condition of pure cellulose. The following are the constants for the more important fibrous materials of the above class :—

	Percentage of Cellulose.	Length of fibre.
Adansonia	55·0	3–5 mm.
Wood (coniferous)	53·0	1–3 ,,
Straw	52·0	1–2 ,,
Esparto	52·0	1–2 ,,

So far, in dealing with these several classes of raw materials, we have introduced (1) the primary constants, which have reference to the cellulose and the ultimate fibre of which it is made up, and (2) we have spoken in a general way of the properties of the "non-cellulose." It is impossible within the narrow limits of this report to deal with the large number of minor characteristics, both of the raw fibres and of the celluloses isolated from them, which necessarily have to be taken into account by the investigator in determining the position of a fibre in the scale. A brief description of the scheme of analysis which has been adopted in the investigation of the fibres will suffice to show what are the more important of these. The statement of the results of analyses is given in the following manner :—

	Moisture	Hygroscopic water or water of condition.
Separate portion taken for each determination. Results calculated in percentage of dry substance.	Ash	Total residue left on ignition.
	Hydrolysis (*a*)	Loss of weight on boiling raw fibre 5 minutes in 1 per cent. solution of caustic soda.
	,, (*b*)	Loss of weight on continuing to boil 1 hour.
	Cellulose	White or bleached residue from following treatment: (1) boil in 1% NaOH 5 minutes. (2) Exposure to chlorine gas 1 hour. (3) Boil in basic sodium sulphite.
	Mercerising	Loss on treating 1 hour with 33 per cent. solution caustic potash—cold.
	Nitration	Weight of nitrated product obtained by treatment with mixture equal volumes nitric and sulphuric acids, 1 hour in the cold.
	Acid purification	Raw fibre boiled 1 minute with acetic acid (20 per cent.) washed with water and alcohol and dried.
	Carbon percentage	The carbon in the fibre from above, determined by combustion.

For a more detailed account of the above chemical methods, a paper published in the "Chemical Society's Journal," 1883, p. 23, should be con-

sulted. Those interested in the microscopic investigation of fibres should consult M. Vétillart's work, "Études sur les fibres végétales textiles," of which a very good abstract, by the author himself, is published in Mr. Christy's "New Commercial Plants and Drugs," No. VI.*

Having thus taken a general survey of our subject-matter and laid down the fundamental principles upon which these plant fibres require to be investigated, we may now proceed to the results of the particular examination of the raw materials to be found in the Colonial sections of the Exhibition.

Our commerce in this department has been hitherto very limited, nor have the Colonies developed any considerable manufacturing industry on the basis of a home supply of such raw materials. With India, on the other hand, not only have we an extensive commerce, but the multitudinous fibres obtainable from its extensive flora have been so studied by scientific observers, native and European, as to have given us a systematised technology of the subject. It is not surprising, therefore, that we find in the Indian section of the Exhibition that which can scarcely be said to be afforded by any of the Colonial sections—an extensive and well-authenticated collection of fibrous raw materials. These have been submitted to exhaustive investigation by the writer in collaboration with others, and the results will be submitted as a report to the Indian Government and published by them. Those of our Colonies having a similar flora, more especially the West Indian, will be able to take advantage of the information therein to be published; and as it will contain a full account of the scientific methods pursued, it will be advisable for those who follow up this aspect of the subject to read it as complementing the present report, which is necessarily somewhat meagre.

CANADA.

It is to be regretted that the attention of flax-spinners was not directed, by exhibits, to the question of the future importation of flax-straw and dressed fibre from this Colony; on the other hand, the subject has been publicly ventilated at a Conference held under the auspices of the Commission, at which a paper was read by Mr. E. B. Biggar. While recently in Belfast, inspecting the new Cardon flax-dressing machine at the works of Messrs. Combe, Barbour and Combe, I had the opportunity of putting some Canadian straw through the process. The yield was fully 25 per cent. on the straw, and the fibre of excellent quality. The impression created in Belfast is such as to lead us to anticipate a large trade with the Colony in flax. The importation into this country from the Continental flax-growing centres reached in 1880 the large total, in money value, of $3\frac{1}{2}$ million pounds (sterling); for this trade competition has now opened out new channels, the most important of which is Canada, with its unrivalled agricultural capabilities. It is unnecessary to

* The best general scientific account of the vegetable fibres will be found in Spon's "Encyclopædia of the Industrial Arts," 1881: Article 'Fibrous Substances.'

enlarge on a matter which has the attention of practical men, both here and in the Colony. I may allude, however, to what I said in introducing the subject, in regard to the conflict which will ensue, in response to the keen demands of competitive trade, between new fibres on the one side, and increased supplies of the old on the other. The more we know of the properties of flax, the more the conviction grows of its many-sided superiority. Supposing a largely-increased cultivation of the plant, and allowing all that is claimed for the new flax-dressing machines, both in regard to increased yield and superiority of condition, it is certain that both fibre and fabrics will be produced at increasingly lower prices. A corresponding increase in the aggregate consumption will depend ultimately upon the limit of profitable production, and the extent to which flax can displace the competing fibres, cotton and hemp, which again is very much a question of intrinsic superiority; on both issues we may expect the consumption of flax to increase largely, and to some extent, therefore, to the prejudice of new fibres which may be introduced to commerce. The subject is a complicated one, and practical considerations based on first principles must "give us pause" in dealing with new problems in fibre-commerce lest we yield to the illusory claims of mere novelty, and forget the *à priori* claim of long-established usage. Such considerations have peculiar force in reference to flax, and I have not neglected what appeared to be a favourable opportunity of insisting upon this side of the question.

There is another department of the fibre industry in which Canada will doubtless play an increasingly important part, and that is the production of wood pulp for paper-making. There were a number of exhibits of mechanical wood pulps in the Forestry Section (Group II. Class 2) to which it is not necessary to allude more specially, as these are already articles of commerce. In Class 2 of Group V. also, there was an exhibit of chemical pulp prepared by the Canada Paper Co., Montreal, which is deserving of mention, as also are the papers manufactured by the same company. This subject will be found thoroughly discussed in all its aspects in the reports of the Forestry Exhibition, Edinburgh, 1884, and it would be out of place, therefore, to enter here into a detailed discussion.

AUSTRALIAN COLONIES.

There were no exhibits in the sections of New South Wales and West Australia to which particular attention can be directed.

In the former I found specimens of bast from various species of Sterculia, but these were of no especial interest. In Western Australia there was a specimen of the indigenous Spinifex, with a rope of native manufacture. Mr. George Whitfield exhibited two bundles of fibrous plants (identified by Mr. Jackson, of Kew, as a species of Daphne), with the view of their being investigated by a paper-maker. The low yield of Cellulose (24·6 per cent.), however, together with their very imperfect preparation, precluded any useful result.

The South Australian Commissioners exhibited two fibrous substances—

" Mullett's " fibre, the long sword-shaped leaves of the *Lepidosperma gladiatum*, and " Porcupine Grass."

These fibres on analysis yielded the following percentages of cellulose repectively: 34·4 and 36·5. The *Lepidosperma* examined in transverse section, under the microscope, was found to contain a fair proportion of fibrovascular bundles, of which the constituent bast fibres have an average length of 1·5–2·5 mm.

These results were such as to justify a paper-making experiment, for which, with commendable foresight, the Commissioners had brought a sufficient quantity. The raw material was sent to the well-known paper mill of Mr. E. Joynson, of St. Mary Cray, Kent, he having kindly volunteered to personally superintend the work of converting it into paper. The substance was " pulped " by the process of boiling, at 40 lbs. pressure, with basic sulphite of soda (20 per cent.); afterwards washed, bleached, and beaten in the ordinary way. A small portion was made into sheets on a hand frame, and yielded a paper of a slight yellowish colour, which left nothing to be desired in point of strength.

The bulk was run on the machine, the operation being witnessed by Sir Samuel Davenport and Mr. Scott. Here also an excellent paper was produced, exceptionally strong, and taking a good finish in the glazing rolls. The result was altogether satisfactory, and Mr. Joynson asked to be supplied with sufficient raw material for making a ton of paper, in order farther to demonstrate its paper-making qualities. This request has been complied with, and a quantity of three tons is now on its way. It is intended to make this into paper for exhibition in Adelaide this year. The Porcupine Grass having been found on preliminary investigation to be more nearly allied to the well-known Esparto, was pulped on the usual plan of treating the latter, viz., boiling under pressure with Caustic Soda solution. The grass, however, having been collected by amateurs, and therefore with a plentiful admixture of roots and seeds, yielded a very unpromising mixture. By carefully picking over a small portion, and beating it in a model beater, after bleaching, some excellent pulp was obtained and made into sheets on the frame. In this way the paper-making qualities of the fibre was satisfactorily demonstrated.

In these two raw materials, therefore, the Colony has a supply of good paper-making fibre: their value will of course be determined very much by local considerations. The papers which they make are similar to those obtained from Adansonia and Esparto respectively, the yield being some 10-15 per cent. less. This will convey a better idea of their market value than an attempted money estimate, which would probably be misleading.

In the Victoria Section, Mr. Guilfoyle, the director of the Botanic Gardens, Melbourne, exhibited specimens of fibres, and also contributed very interesting notes upon the same in the Handbook. It was scarcely expedient to repeat upon these specimens investigations already completed with the fibres in the Indian and other sections. The results of these taken together with Mr. Guilfoyle's notes will be of interest to those who are considering the question of the production of fibres in the Colony. Baron von Mueller's name occurs several times in the Catalogue, but not in connection with fibres. It may be of interest to mention that I received from him, during the course of the experiments upon *Lepido-*

sperma above detailed, a specimen of fibre obtained from this plant by means of the Sulphite treatment, which I had brought before his notice.

In the Queensland Section there was an interesting exhibit of "fibres grown near Brisbane, and prepared by Mr. A. McPherson." This contained some very fine specimens of Jute, and also of the fibre of *Sida rhombifolia*, the latter being especially noteworthy. These fibres are similar in their main characteristics; but while they may be classed together, the Sida is unquestionably superior. This is shown, first, by comparison of chemical composition, the results of analyses of the raw fibres being as follows:—

	Jute.	Sida.
Moisture	10·3	10·7
Ash	1·2	0·6
Hydrolysis (*a*)	15·0	6·6
Hydrolysis (*b*)	18·0	12·2
Cellulose	75·0	83·0
Mercerising	16·0	6·6
Nitration	125·0	137·0
Acid purification	1·0	0·1
Carbon percentage	46·5	45·0

The Cellulose in either case is obtained in the form of ultimate fibres of the normal type, the average length being 2mm. in both, the diameter 0·015 mm.

Secondly: Sida shows superiority in point of uniformity, fineness and divisibility of the fibre bundles, and further in softness and in the colour of the raw fibre, and also in capacity for bleaching: the dyeing capacity of the fibres is about equal. It is interesting to note that the distinctions in favour of Sida are closely correlated with the above results of analysis.

The net result of the comparison is, that while belonging with Jute to the lower grade of textile fibres, Sida is much to be preferred, and should certainly displace Jute, more especially in the higher uses to which this fibre is put.

As we are informed that the plant grows luxuriantly in the Australian climate, there is a very strong case already made out for calling the attention of the authorities to the question of the production of the fibre.

The specimens of Jute exhibited were of unusually good quality.

Mr. McPherson also exhibited fibres from the *Hibiscus sabdariffa*, obtained from the plant by the somewhat novel process of "exposure to the weather for five months." The specimen yielded on analysis 71 per cent. Cellulose, the ultimate fibres closely resembling those of Jute.

In this exhibit there was a sufficient demonstration of the fibre-producing capabilities of the Australian Colonies, and the matter will no doubt be taken up practically in proportion as a supply of fibrous materials comes to be demanded for home manufactures.

NEW ZEALAND.

In this Court the only exhibit of Vegetable Fibres was that of *Phormium tenax*, including both machine and native (Maori) dressed fibre, and a number of yarns and cloths, spun and woven from the same. As is well known, this so-called New Zealand Flax has been the subject of extensive investigations, with the object of improving the methods of preparation, and extending the applications of the fibres, without, it must appear, anything like commensurate results. Having studied the reports which have been published, and also made an investigation of the fibre upon the lines laid down in this report, I shall briefly note the judgments I have formed upon the capabilities of the fibre, with the evidence upon which they are based.

It is scarcely necessary to point out that the terms Flax and Hemp, which have been applied to the fibres, even with the qualification of "New Zealand," are misleading, as misnomers usually are. Nothing can be clearer than the distinctions established by investigations, both chemical and morphological, between the two great types of Vegetable Fibres—the bast fibres of the Exogens, and the fibrovascular bundles of Endogens: nor can these distinctions be more clearly brought out than in a comparison of the "constants" of Phormium fibre with those of Flax or Hemp. The following are the results of analyses of the machine-dressed fibre in the Exhibition, and of a specimen of Irish Flax of somewhat low quality:—

	Phormium.	Irish Flax (Heckled).
Moisture	11·4	9·1
Ash	0·75	1·6
Hydrolysis (*a*)	13·6	13·3
Hydrolysis (*b*)	21·2	22·1
Cellulose	67·5	80·2
Mercerising	19·5	8·4
Nitration	96·9	125·0
Acid purification	1·5	4·3
Carbon percentage	45·0	43·2
Mean $\frac{\text{length}}{\text{diameter}}$ of ultimate fibres	$\frac{8 \text{ mm.}}{0{\cdot}015 \text{ mm.}}$	$\frac{33 \text{ mm.}}{0{\cdot}02 \text{ mm.}}$

The main distinctions are (1) the relatively low percentage of cellulose in Phormium; (2) the very low yield of the nitration product, which indicates the presence of cellulose of very inferior stability—this is confirmed by the relatively large loss in mercerising; (3) in morphological characteristics, the flax consisting of bundles containing, at any point, but few fibres, whereas the Phormium bundles are very large, and for the most part complex in structure, and therefore variable, containing a preponderance of bast cells (very thin-walled compared with flax), with a central core of vessels, the whole enclosed in a monocellular parenchymatous sheath.

Such distinctions we cannot fail to see are correlated with distinctions in physiological function: and that this is so will be more clearly elucidated in the forthcoming report on Indian fibres before alluded to, in which the number of fibres examined is sufficient to admit of general conclusions.

These distinctions, moreover, must determine the different applications of the fibres in the arts, and the evidence we have discourages any attempt at replacing the fine spinning textile fibres of Exogenous origin by their poorer relations the fibres of the Monocotyledons. While, however, Phormium will never be entitled to rank with Flax and Hemp, there is, we think, with Phormium, as with certain others of this class of fibres, a higher use than those to which they are at present applied. This will depend, in any one, first upon the degree of fineness, which also involves uniformity, and divisibility which it has, naturally, or to which it can be reduced by chemical treatment; and secondly, upon the cost of production.

Now Phormium is distinguished amongst the Monocotyledons * by its very large yield of fibre, which of course favourably influences, in direct ratio, the second consideration. The question therefore of newer applications resolves itself rather upon the former issue. The comparative fineness of the native-dressed fibre shows that careful selection and preparation of the raw material †—which are characteristic of the Maori treatment—can accomplish much in this direction; but this superiority of method is not realisable commercially, or at least only partially. We have therefore to consider the alternative, or chemical, treatment. In the report of the Commissioners of the New Zealand Exhibition of 1865 we find strong testimony in favour of a mild alkaline treatment of the raw material. To quote from this report: "They" (*i.e.* the alkalis) "enable us to clean the fibre with ease, but they impair its strength, always imparting to it a brownish tint, which can scarcely be looked upon as other than a sign of decomposition. In the use of soap—the last chemical experimented upon—we have all the advantages obtained by the use of the alkalis, without their disadvantages; but the high price of this article would prevent its adoption for this purpose if used alone." Then, after suggesting the joint use of soda (carbonate) to minimise the quantity necessary to use, they conclude by saying, "The fibre obtained in this way is easily cleaned, is not discoloured, and appears as strong as that prepared without the use of chemicals."

Quite apart from the recommendations of the Commissioners in the particular case of Phormium, the hydrolytic action of the alkalis has long been known and used as the most effective and safest way of treating raw fibres for the removal of non-cellulose impurities. In recent years a great deal of work has been done with the *sulphites* in this direction. The results obtained with the basic alkaline sulphites are such as to give a complete range of treatments down to the isolation of the ultimate fibres; with the minimum of chemical modification of the fibre constituents, and therefore alteration of the natural colour of the fibre. It is impossible in this report to do more than consider the more practical questions involved: and I must limit myself to a bare statement of the advantages of sulphite of soda in relation to the treatment of Phormium. Its solvent action is superior to that of soap; the combination of the base with sulphurous acid gives to the compound a deoxidising power, the effect of which upon the fibre is a notable bleaching action; owing to recent improvements in manufacture it can be produced at a cost one-third that of soap, and, it

* 15–20 per cent. on the green leaf as compared with the average 3–7 in Aloe, Manilla, &c.

† It is interesting to note that the mean length of the ultimate fibre was determined at 11·15 mm. in the native-dressed specimens, as against 8 mm. in the machine-dressed.

is worthy of note, at about one-third of the cost of the crystalline compound formerly exclusively known to commerce. The process of treating fibres and raw fibrous materials with this sulphite, patented by myself in England in 1880, has been worked out with considerable success by Mr. J. P. Strangman, of Sarno, Italy, for the preparation of a finer spinning fibre from dressed Italian hemp. This gentleman accompanying me in one of my rounds at the Exhibition, expressed his willingness to test the process upon the machine-dressed Phormium. Sir Julius von Haast having been approached on the subject, secured the co-operation of Mr. D. W. Bell, of 14, Milton Street, E.C., who shipped a parcel of 12 cwt. of fibre to Italy. The results of the contemplated experiments will be announced in due course. Such a process is of course different from that recommended by the Commissioners, in starting from the dressed fibre; the purpose, however, is the same. In the face, however, of these recommendations, above quoted, a trial of this method of treatment upon the green leaves is to be urged upon the attention of the authorities. I have made laboratory experiments with leaves supplied to me by Sir Julius von Haast: on scutching the leaves after treatment a very superior fibre was obtained. On examining this fibre in section under the microscope the bundles were found to be satisfactorily divided, and largely freed from their cellular sheath. In colour and softness the product was far superior to the machine-dressed fibre. It remains to consider what are the possible applications of the finer fibre, thus prepared. Mr. Strangman proposes to put the products which he obtains through the ordinary twine-spinning machinery. It will be as well not to anticipate the results of this trial by any predictions.

There is another application which I am investigating, with the kind assistance of my friend Mr. J. R. Barlow, of Bolton, who has undertaken the experiments—that is, a process of reduction of the treated fibre to something like the staple of raw cotton: a treatment which has been successfully applied to the spinning of yarn from various wastes. The reduction is effected in a special machine from which the resulting "wool" is taken through the carding process and spun into a weft yarn. The results of the trials of this process upon the treated Phormium will be duly reported.

Reverting to the treatment of the green leaves, attention should be directed to the employment of the rejections of the leaves, and the fibrous waste as a paper-making material. From the air-dry leaves exhibited in the collection, 49.5 per cent. of cellulose was isolated by the ordinary method. Such a yield—which would be sensibly the same for all parts of the leaf—taken together with the comparative ease of isolation, and the satisfactory length of the ultimate fibre, leads to a favourable estimate of its value for paper-making: sufficiently, at least, to afford a "set-off" against the cost of producing the fibre. This has doubtless been considered, but finding no mention of the matter as having been put to a practical test, I have thought fit to mention it in passing.

In submitting these considerations, I am sensible of the difficulty of contributing to elucidate a problem which has already and for many years engaged the attention of distinguished men both here and in the Colony. Still, in spite of the excellent work which has been done, it does not appear that there is a definite estimate, scientific or commercial, of the capabilities of the Phormium Fibre; and if this communication is effective in the least degree in stimulating further inquiry, it will have fulfilled its purpose.

It may not be out of place briefly to summarise the results of this recent investigation of the matter.

The reports of the Commissioners (1870–1872) point to an inadequate investigation of the chemistry of the fibre, the methods adopted being empirical and not uniform with those now generally adopted; consequently the question of chemical modification of the fibre for the improvement of its quality, as well as treatment of the raw material for the same end, has not been fully investigated. Such an investigation is the more promising of practical result in the case of Phormium, on account of the exceptionally high yield of fibre. Experiments have been undertaken under the auspices of the Executive Commission, starting with the machine-dressed fibre, to test the various treatments with alkaline sulphites, which in more recent times have been successfully applied to other raw fibre and fibrous materials; and further to test the spinning qualities of the resulting modified forms of the Phormium fibre. It would be desirable to put the green leaves through a similar treatment with the view of preparing a finer fibre in the first instance. The rejections of the leaves and fibrous waste, yielding a good percentage of long fibre, should constitute a satisfactory paper-making material; and upon this a definite estimate should be taken.

Considering for a moment, in conclusion, the present position of Phormium as a fibre competing with Manilla for rope-making fibres, laboratory investigation rather establishes the superiority of the former than justifies the preference which has been given to the latter.

The following results were obtained with a selected specimen of Manilla:—

Moisture	10·5 per cent.	
Hydrolysis (*b*)	13·5	,,
Cellulose	58·0	,,
Ultimate fibres. Length	3–7 mm.	

There is a very close structural resemblance between these fibres,* as might be expected from their physiological similarity. The chemical composition will vary to a certain extent with the method of preparation: but the comparison having been made upon specimens very similar in condition may be taken as fair. The matter appears to require further investigation.

FIJI.

The exhibits in this section were perhaps rather of technical than commercial interest, though there were indications of possible developments in the latter direction. The most noticeable feature were the curtains which adorned the entrances to the Court. These native productions are made from the prepared bast of the Broussonetia or paper-mulberry, and adorned with barbaric designs, printed, as the Commissioner informed me, by means of such primitive apparatus as a plantain leaf

* Compare Prof. McNab's Report to the Commissioners.

for stencil plate, the colours, a black and brownish-red, being suitably thickened. Though not of high quality, individually, they produce a very harmonious blend, and quite in accord with modern taste.

In addition I found samples of Musa fibre well cleaned and of good length, and coir fibre with twine and rope made from the same; also twines of native manufacture worked into fishing-nets, made from the so-called van fibre.

Although there is no mention in the "Handbook of the Colony" of any commerce in miscellaneous fibres, there can be no doubt that this branch of trade is capable of development in the Colony.

AFRICAN COLONIES.

In the Cape Colony section but little attention appeared to have been given to the subject of fibres. The only specimen inviting investigation was a fibrous bark (unnamed) in the exhibit of the forest department. This yielded on analysis 48 per cent. of Cellulose; the ultimate fibres were of satisfactory length. The raw material was exceptionally clean, and readily yielded to the action of weak alkalies: all these points considered, therefore, it may be looked upon as taking a place amongst paper-makers' raw materials.

NATAL COURT.—Amongst the fibres, which formed a somewhat prominent feature, I found a specimen which from its external characteristics alone was at once to be identified as belonging to the highest class of textile fibres. From the descriptions of the Exhibitors, General Bissett and Dr. Sutherland, it is known in the Colony as "Native Hemp," and is said to be obtained from a plant of the Hibiscus order. At the time of writing this report the above description has not been verified; but the question of identification, with that of the source of supply, having been taken in hand by the Kew authorities—by whom, in fact, my attention was first directed to this fibre—it is unnecessary for me to say more on this point. Chemical and microscopic investigation fully confirmed the impressions obtained on preliminary inspection. The following are the results:—

Moisture		9·4 per cent.
Ash		3·5 ,,
Hydrolysis (*a*)		13·7 ,,
,, (*b*)		22·3 ,,
Cellulose		76·8 ,,
Mercerising		12·5 ,,
Nitration		117·0 ,,
Ultimate fibres.	Length	25–80 mm.
	Diameter	0·032 mm.

The constants for this fibre are in the main similar to those of flax, while the ultimate fibres are distinguished by even greater length. Although the

number of ultimate fibres in the filament is larger, varying from two to fifty, the adhesion is but slight, and easily resolved. The raw fibre is, further, also distinguished by giving a violet reaction with Iodine (Schultze's solution), which is characteristic of fibres of only the highest class. Unfortunately the fibre had not been prepared with sufficient care to enable us to put it through a fine-spinning trial, on flax machinery. A certain proportion of bark still adhered to the fibre, and this would have made the heckling a very wasteful process. Having only a small quantity of fibre at command, we therefore put it through the special process, mentioned in the report on *Phormium tenax*. The fibre was first submitted to an alkaline treatment for the removal of bark, and after drying, was torn up into short staple fibre and spun on cotton machinery. The yarn obtained was of a greyish colour, bleaching easily, under the ordinary treatment, to a full white. It was remarkably soft to the touch, more nearly resembling an Angola yarn than flax or cotton. It is scarcely necessary to point out that the highest capabilities of the fibre are not brought out by such a treatment, but the trial was nevertheless useful as a demonstration of its spinning properties. The fibre has been submitted to flax-spinners of experience, and from inspection, together with the results of laboratory investigation, they have formed a high estimate of its value.

These are only preliminary results, but they are of sufficient importance to warrant an extended investigation of the fibre, with the view to its introduction to commerce.

In addition to the above there were specimens of *Fourcroya* and other Monocotyledonous fibres. I did not repeat upon these specimens investigations already completed upon other sections: and for information upon these fibres the special reports of the Indian and West Indian sections should be consulted.

WEST AFRICAN COLONIES.

In these sections I found specimens of very interesting nature. The textiles of native production are extremely ingenious and tasteful in their combinations of colour. From amongst the raw fibrous materials the following were selected for special investigation :—

(*a*) Bast. Exhibited in the Gambia Section, but not further described. Used by the natives for a number of purposes. The fibre itself, when isolated, closely resembled jute in appearance; while from specimens showing the bast *in situ* (a stick stripped, the fibre remaining attached so as to form a species of whip), it appeared to be closely allied to the West Indian Mahoe. The following determinations were made :—

Moisture		11·0 per cent.
Hydrolysis (*a*)		8·4 ,,
Cellulose		74·5 ,,
Nitration		121·0 ,,
Ultimate fibres.	Length . . .	1–3·5 mm.
	Diameter . . .	0·02 mm.

This fibre is very similar in composition, chemical and structural, to jute, and is capable of similar applications. From the specimens it was to be concluded that they were obtained from a perennial, from the main stem or more probably the branches. In regard to a probable commercial future for this fibre, the most favourable conditions of growth of the plant should be first determined. Questions of this nature are outside our province, but it scarcely needs to be mentioned that the authorities at Kew are always ready to advise and assist in the necessary investigations.

(*b*) A fibrous Bark, in the Gold Coast Section. A bale of this was exhibited by Dr. J. F. Esmond, of Accra, with a request that it should be put through a paper-making trial.

In external appearance it was not unlike the Adansonia, except in being comparatively free from medullary matter. The following determinations were made :—

Moisture	11·0 per cent.
Ash	7·6 ,,
Cellulose	66·5 ,,
Ultimate fibres Length	10–15 mm.

Not only in the relatively high yield of cellulose, but in the exceptionally great length of the ultimate fibres, this material is such as to command the attention of paper-makers. It only remains to add that the substance is easily treated, and that the resulting pulp bleaches under the ordinary treatment to a high colour.

Messrs. Joynson have kindly undertaken a paper-making trial of the substance, the results of which will be reported in due course.

(*c*) Grass (epidermal strips of *Ratia vinifera*). Exhibited by Mr. A. Sibthorpe in the Sierra Leone Section, with specimens of straw plait illustrating its more usual application by the natives.* This specimen also proved itself on analysis to be worth the attention of paper-makers. The following determinations were made :—

Moisture	9·8 per cent.
Ash	2·7 ,,
Cellulose	60·8 ,,
Ultimate fibres. Length	1·5–2·5 mm.

It is needless to say that the raw material is particularly clean; in length of fibre, but more especially in yield of cellulose, it is superior to Esparto; it only remains, therefore, to determine the cost of production, and if within the limit, to introduce this raw material into European commerce.

Notwithstanding that, as is to be judged from appearances, but little attention has been bestowed upon the fibre exhibits in this section, results have been obtained which should stimulate inquiry into the undeveloped resources of these Colonies, in the department of miscellaneous fibres.

* A further examination of this substance comparatively with Raffia, which still commands a high price amongst gardeners and nurserymen, showed that it was so closely similar as to be applicable to precisely the same uses, and such an application would of course take precedence of that above indicated. This fibrous material is well worthy of further attention.

WEST INDIAN COLONIES.

In these sections the exhibits of miscellaneous fibres are more prominent: and the matter is doubtless of first importance to the commerce of these Colonies. It is scarcely necessary to point out that there is a general resemblance between the flora of the tropical countries of the East and West hemispheres, sufficient to warrant our regarding India and the West Indies from a common point of view; and the results of our investigation of the Indian fibre exhibits will in a great measure apply to those of the latter. In determining questions of commercial value, on the other hand, the conditions which have to be taken into account are very different in the two cases, and further are by no means uniform for the several members of the West Indian group. On these latter points I can only offer very general remarks, which I reserve until I have detailed the results of the special investigations which have been made.

Amongst the exhibits the Monocotyledonous fibres largely preponderated; indeed but little attention seems to have been bestowed upon the working of the bast fibres of indigenous Exogens. From the various Courts I selected well-dressed specimens of the following: Penguin (*Bromelia P.*), *Sanseviera Zeylanica*, and *Agave Keratta.* These are to be found in nearly all the exhibits of the various sections. In the St. Vincent Court I found a small specimen of the Groo-Groo (or Gri-Gri) fibre, obtained from the *Acrocomia sclerocarpa*, which is distinguished from the other fibres of this class by its remarkable fineness and softness; and this superiority is confirmed by a comparison of the results of the analyses, which are as follows:—

	Penguin.	Sanseviera Z.	Agave K.	Gri-Gri.
Moisture . . .	10·0	9·7	10·5	10·3
Ash	1·3	—	1·4	3·4
Hydrolysis (*a*) . .	12·6	12·0	10·0	7·6
,, (*b*) . .	22·8	24·4	20·0	16·5
Cellulose . . .	67·2	73·1	75·8	83·5
Mercerising . .	22·5	—	11·0	11·2
Nitration . . .	103·5	105·6	103·8	118·3
Acid purification . .	3·1	4·5	0·4	0·7
Ultimate fibres. Length	1–2 mm.	1·5–2·5 mm.	2–8 mm.	1·5–3 mm.

Comparing the lengths of the ultimate fibres, the Agave must be pronounced the superior fibre; whereas chemical analysis shows the fibre constituents of the Gri-Gri to be the more stable, and this fibre is to be preferred on account of its superior fineness. In discussing the subject of Phormium I have alluded to the general inferiority of the Monocotyledonous fibres, and the causes structural and chemical. If the above results be compared with the numbers there given, on the one hand, and with the analysis of a high-class bast fibre such as flax, which is also given, or the native hemp of the Natal Colony, this class-similarity and inferiority will be the more emphasized. So also I have alluded to the question of yield of fibre from the green raw material, and to the superiority of Phormium in this respect to all other fibres of this class. In recommending any of the above fibres to the attention of West Indian cultivators, this question must

be taken next in order; after which there comes the question of the process of obtaining the fibre, together with those of supply and transport. Assuming a satisfactory decision on these latter points, attention should be confined in each locality to one, or at most two, of those which have been shown to be superior. Much time has been wasted by diffuse investigations in the province of fibres, and the cause lies in the absence of recognition of the precise criteria of value. It is quite certain that the conditions of European markets and manufactures are not such as to encourage any large increase in the *number* of vegetable fibres, more especially of the Monocotyledons. The struggle is severe, and only the fittest survive. There is no necessity for the future that the question of fitness should be left to work itself out. The application of criteria, now well established, enables us to make definite selections on the basis of superiority. The authorities in the several islands should decide generally that the growth and preparation of a fibre is desirable, then a particular fibre—the best for each locality—should be selected, and the trade in that fibre thoroughly organised. The importance of an organisation cannot be overestimated, and in support of this we may cite the case of the trade in jute. There are, as we know from the results of investigations, not a few fibres capable of replacing this particular bast, some in fact of the same class being superior in all essentials. Nevertheless the trade in jute holds its own unassailed, and the cause, in so far as it does not reside in intrinsic superiority and commercial fitness, must be sought in the concentration of attention upon this fibre, and the resulting organisation of the trade. These facts deserve to be borne in mind by all who are contemplating the founding of any such enterprise.

In this report the subject can only be dealt with on general principles. In its special and local aspects the matter has been made the subject of exhaustive investigation by Mr. Morris of Kew, during his residence in the West Indies, and an excellent account of the results of his work are given in a lecture delivered under the auspices of the Institute of Jamaica, February 5th, 1884, and subsequently published. In this treatise there is a very full account of the Monocotyledonous fibres, and the practical questions involved are very effectively handled. Under the guidance of the recommendations therein given, and the results of scientific investigation of the isolated fibres, there should be no difficulty in arriving at clear decisions on the matter in its relation to the trade of the West Indies.

Coming now to the second group of fibrous substances, the Exogenous bast fibres, we find that hitherto these have received but little attention in the West Indies, at least in regard to external commerce. The conditions of the competition with India in this field have been and are probably still too severe for satisfactory commercial results. Into this question it is not for me at present to enter. Amongst the exhibits there were only a few fibres of this order; of these the following were selected for investigation :—

Mahoe.—A very good specimen of this bast was exhibited in the Jamaica Court: the strands were about 9 feet in length, of a cream colour, clean, the fibres showing a fair degree of fineness and divisibility. A second specimen, exhibited in the Trinidad Court, under the name Maholtine, was also analysed. The following are the results :—

	Mahoe.	Maholtine.
Moisture	10·7	11·5
Ash	1·6	1·5
Hydrolysis (*a*) . . .	9·8	12·9
,, (*b*) . . .	14·2	15·4
Cellulose	73·8	72·7
Mercerising	9·6	9·0
Nitration	96·9	94·4
Acid purification . . .	3·4	6·3
Carbon percentage . .	45·2	—
Ultimate fibres. Length .	1–1·5 mm.	1–1·5 mm.

There can be no doubt of the identity of these fibres.

This bast is in the main similar to jute, superior in regard to resistance to hydrolysis, but apparently inferior in regard to the cellulose. These specimens were isolated presumably from a well-aged, free-growing plant. The results would justify an investigation of the modifications in the fibre, determinable by artificially modifying the conditions of growth of the plant. Being one of the most widely distributed throughout the West Indies, and the qualities of its fibre having been already tested by native applications, the question of a probable wider application of this fibre is worthy of investigation.

In addition to the Mahoe, which from its extensive distribution is presumably the most important, specimens of the following have been analysed :—

Pavonia Zeylanica, also a free bast, and capable therefore of textile application, and Sugar Bark (*Malvaviscus arboreus*), *Malva sylvestris*, and Daphnopsis, the three latter appearing from the analysis to be capable only of a possible application as paper-making fibres :—

	Pavonia Zeylanica.	Malva Sylvestris.	Malvaviscus Arboreus.	Daphnopsis.
Moisture	8·7	12·1	10·7	13·2
Ash	3·4	2·7	4·9	4·5
Hydrolysis (*a*) . . .	11·0	19·2	19·9	27·0
,, (*b*) . . .	12·8	27·6	24·5	31·2
Cellulose	75·0	57·0	65·0	63·0
Mercerising . . .	14·2	—	—	—
Nitration	107·6	92·8	79·3	—
Acid purification . .	6·8	4·7	—	—
Ultimate fibres. Length	1–1·5 mm.	5–12 mm.	1·5–2 mm.	5–7 mm.

On the above results the Pavonia is noticeable for the evidences of a "sound" chemical constitution, and *Malva sylvestris* for the satisfactory length of its ultimate fibres. If improved by cultivation these fibres would be doubtless capable of application.

The *Malvaviscus* and *Daphnopsis* fibres might prove useful to the paper-maker: more especially the latter, by reason of the length of the ultimate fibre.

There are two fibres of this class which are deserving of general mention as having a probable future in West Indian Commerce, viz. Rhea and Sida. The former has been so extensively discussed that it would be impossible to add anything of practical significance to what is already known ; the

subject is moreover treated in its relation to the West Indies by Mr. Morris in the brochure already alluded to.

Sida rhombifolia, which is also mentioned by Mr. Morris as indigenous to the Islands, has been discussed in the report upon the Queensland section, in which very excellent specimens were exhibited. It is unnecessary to repeat what has there been said. The fibre is certainly equally deserving of attention in the West Indies.

Reverting to the exhibits, we come to those included in the lowest class of raw materials.

In the Guiana section there are—in addition to fibres identical with those already described—a number of basts, of which I selected two for special investigation, as typical of the class. They are described under the native names, Enouroo and Kokoyoko. The following results were obtained on analysis:—

	Enouroo.	Kokoyoko.
Moisture	12·1	13·3
Ash	7·4	3·8
Cellulose	50·5	38·0
Ultimate fibres. Length	1–2 mm.	3–4 mm.

These substances cannot be considered therefore as having any value for the European markets.

Megass.—Some attention has been given to this refuse as a raw material for paper-making; and a good specimen of half stuff, rolled into sheets, is exhibited. In its general features the pulp obtainable from the sugar-cane is similar to that yielded by the bamboo, as is only to be concluded from the close affinities of the plants. It is inferior, however, in containing more cellular *débris*, and in length of fibre, the bast cells seldom exceeding 2·5 mm., whereas the average in bamboo is 3. Such a material cannot be recommended to paper-makers; and it is doubtful whether by any process it could be converted into a useful paper-making material at a reasonable cost.

Banana.—Lastly, we have to consider a fibrous substance, also very low in the scale of raw materials, but which would be of great importance to these Colonies, provided it could be suitably and cheaply prepared, and an outlet found for the product; this substance is the refuse stalks of the edible Banana. The fibrous basis of these stems are ultimate fibres of fair length (2–3 mm), and of which the paper-making properties are well established: they are, moreover, easy of isolation. The specimen of "Musa Stock" exhibited in the Jamaica Court yielded on analysis 27 per cent. of cellulose. By long boiling in weak alkali, then bruising and washing to remove cellular matter, and bleaching in hypochlorite, *i.e.* a paper-maker's treatment, I obtained from the raw material 31 per cent. of a well-bleached, clean, tough fibre, a most useful basis for strong wrapping papers. On the other hand, so low a yield must be regarded as prohibitory. Of course it would be perfectly easy to concentrate the substance, as I may term it, in removing the cellular matter by a simple treatment such as that above described; and it is needless to say that a raw material yielding on treatment 50 to 60 per cent. of such fibre would command a fair price in European markets. The question of the preparation of the Banana stems into a paper material for export has been fully dealt within its local aspects by

Mr. Morris, in the pamphlet before alluded to. On this side of the question, therefore, we need say nothing. The commercial issue entirely depends upon the cost of putting down the treated material, at the several ports, in such a condition that under the further treatment necessary for its conversion into a paper pulp the loss shall not exceed, say, 40 per cent. The value of such a raw material I should estimate, at present rates, at about £8 a ton. This matter should be thoroughly tested forthwith, and a decision arrived at.

In this general account of the West Indies in relation to the subject it will be understood that British Guiana and British Honduras are, by their geographical and other circumstances, to be considered as included.

ST. HELENA.

Mr. Morris, in his report upon the resources of this island (1884), has pointed out the possible development of a supply to the European markets of Aloe and Phormium fibre. The latter is the more deserving of attention on account of the much larger yield in percentage of the green leaves. In the above-mentioned report it is, presumably by some mistake, stated at only 5 per cent., whereas in the reports of the New Zealand Commissioners it is returned at from 15 to 20; the difference between the condition of growth in the two islands cannot be such as to affect in so great a degree the structure of the leaf, *i.e.* development of fibre. The yield usually accepted being relatively large, and the conditions favourable to the growth of the plant, there would appear to be good ground for a further serious effort to establish a trade in Phormium.

CEYLON.

In this Court there were exhibited some especially fine specimens of *Sanseviera* and *Feurcræa* fibre. The latter was analysed with the following results:—

Moisture	12·0 per cent.
Hydrolysis (*b*)	11·75 ,,
Cellulose	69·6 ,,
Nitration	104·0 . ,,
Ultimate fibres. Length	3–7 mm.

This specimen, while showing a general agreement in composition with other monocotyledonous fibre bundles, was at the same time of superior quality.

Coir fibre, as well as twine and rope, is an important feature of the commerce of the Colony, and was well represented in the exhibits. The Kitul fibre was also shown, both in the raw state and in the form of ropes.

MAURITIUS.

In this section we have an elaborate collection of fibres from the Botanical Gardens, interesting as a collection, but not opening up any questions of practical import to the commerce of the Colony. There are several exhibits of well-dressed Aloe fibre, in which, it is well known, the island has a well-founded and increasing trade. A full account of this fibre industry, as conducted in Mauritius, is given by Mr. Morris in his account already mentioned of fibre plants available in the West Indies. Those interested in the commerce of the island will no doubt find information in the present report, and in that on the Indian fibres in the Exhibition about to be published, which will be equally available in regard to local questions of fibre production.

BRITISH NORTH BORNEO.

The only fibre exhibited is the Manilla, the only one likely to be of importance in the immediate future. The close proximity of the Colonies to the Philippines, the original home of the Plantain fibre industry, will necessarily induce a competitive trade, and the adoption of similar methods of preparation of the fibre. At the same time it is to be hoped that the resources of the Colony will be fully studied in relation to indigenous fibrous plants.

APPENDIX.

I have received from Messrs. Joynson satisfactory reports upon the papers made (*a*) from the Bast Strips, exhibited in the West African Section. They were treated by the (basic) sulphite process, and bleached to a good colour. The paper was reported to be of exceptional strength. (*b*) From Musa Stock—West Indian Sections. The paper obtained was of a yellowish colour, and of quite peculiar characteristics: being *transparent*, and at the same time taking ink well (without sizeing), as, in fact, not only resembling a tracing paper in appearance, but available for such application.

New processes.—It may not be out of place to direct attention, in the Colonies, to one or two of the more important of these, which are in prominent notice here and on the Continent.

Flax-dressing.—In this department, certain new machines are making an important move. The special feature of the Cardon machine, which has been already mentioned, is the breaking up of the wood of the stem by means of piercing pins; these are set in frames which are disposed in pairs along the first portion of the machine. The flax-straw, held by clamps,

travels between the pins, being arrested at each pair while these travel at right angles to its line of motion, meeting in the centre across the straw which is thus pierced at every point; passing lastly to the second portion of the machine, the flax is lowered into a chamber, in which it comes between the rapidly revolving shaking-wheels, which effectually free the fibre from the comminuted wood. This improved treatment affects advantageously, not only the quantity, but the quality of the fibre obtained.

I quote on these points from a report from Messrs. Combe, Barbour and Combe, of Belfast, with which I have been favoured:—"The results of our trials, and we have now made a great many, have proved to us, that from exactly the same straw, about 40 per cent., more or less, increased yield of fibre is obtained, upon that scutched with the old handles." The reports of spinners as to the quality of the "new" flax are equally satisfactory.

Mather - Thompson Bleaching Process. — This process, which is now well established, effects a very important simplification of the treatment for the bleaching of vegetable fibres and fabrics. The principle of the system is the reduction of each essential treatment, alkaline hydrolysis (boiling) and whitening (or bleaching proper) to a *single operation*, rendered complete by special appliances, mechanical and chemical, and so avoiding the complicated repetitions of the old system. In the treatment of cotton goods, this is effectually accomplished; with linen goods, on the other hand, although owing to the peculiarities in the chemical composition of the fibre, the treatment cannot be reduced to such simplicity, the relative simplification is even greater. The chief feature of the system, practically, is not the chemicals employed, which are those of long standing, but the special apparatus and appliances by means of which they are brought to act upon the fibre or goods. A full account, with drawings, will be found in the "Textile Recorder," January 15, 1886, and the "Engineer," March 19, 1886, which should be consulted by those who wish for further information.

Hermite Bleaching System.—This is based upon the production of bleaching compounds by the electrolysis of solutions of chlorides, more especially of the chlorides of magnesium and calcium. The energy of the current causes the fixation of active oxygen, which is in this, as in all the bleaching solutions at present employed, the effective bleaching agent. It has been found, however, that the oxygen, fixed in this way, has a much greater bleaching activity than the oxygen of bleaching powder. The economy of the system comes to be calculated in the following way:—

Units of current give units of oxygen measured by the ordinary chemical test. These quantities have then to be extended, the first into steam H.-P. per annum, the latter into so much bleaching work accomplished. On such a calculation, all local circumstances taken into account, the advantages of the system are great, even for application in this country; but in those Colonies, where (1) bleaching powder is an "exotic," but supplies of the earthy chlorides are available (*e.g.* mother liquors from sea-salt); and (2) where water-power is plentifully available, the advantages would be much greater. The matter is deserving the attention of technologists in the Colonies.

Having now completed the more special work of reporting upon the exhibits of fibres, and having in the investigation adopted a method which *might* be described as scientific as opposed to practical—though I have

endeavoured to show that in this domain science and practice never should be at variance—I will, in taking a brief concluding survey of our subject, keep to the more distinctly commercial aspects.

First it will be interesting to get a general idea of the amount and distribution of the Colonial and "foreign" trade in miscellaneous fibres and articles manufactured from them. On the next page is a tabular account of the statistics of this trade for the year 1885, for which I am indebted to the kindness of Mr. F. Bailey of the Board of Trade.

Table B contains returns which, though partial in character, will have a particular interest for the trades which they concern. They are of much less importance, in general bearing on the subject, in comparison with the statistics in Table A. These are a fairly complete account of our whole trade in these fibres, and the contrasts of the foreign and Colonial commerce are remarkable.

It is not difficult to see that there is an ample field for a Colonial trade in flax and hemp, at the expense of the foreigner. I have alluded to the exceptional agricultural circumstances which mark out Canada for successful competition in the production of these fibres; the Australasian Colonies may also participate in this new direction of commerce, which we may look upon as certain to be progressively realised.

In jute the disparity between the trade with foreign countries and with British possessions, which in other respects is simply enormous, is considerably modified; and it is not a little remarkable that the trade in this, the lowest of the textile fibres, should be greatest of all. I have shown cause for expecting this fibre to give way before others of the same class but of superior properties; but it is unnecessary to point out that to seriously alter the proportions of so gigantic a commerce will be no light undertaking.

In hemp substitutes and "unenumerated fibres" the West Indies now play an inferior part, but there can be no doubt that a large proportion of this commerce can be wrested by them from those who now hold it.

In paper materials and half stuff, what strikes me as a weak point is the enormous trade in Esparto. By weakness I mean, the absence of any claim on the basis of ultimate properties to occupy a position which at this time might well be regarded as unassailable. It is not an opportune moment to introduce controversial matter, and without further entering into a discussion of this point I simply express an opinion that well-selected basts will vindicate a certain position as paper-making materials to the displacement of Esparto which is now so prominently to the fore.

The general conclusion to be drawn is that, with the single exception of the Indian trade in jute, our Colonial commerce in fibres is insignificant; that on the other hand the producing capabilities of the Colonies are enormous, and such commercial disabilities as may have hitherto prevented the development of the trade, would no doubt disappear when seriously assailed.

Whether we view this branch of commerce in the light of statistics only, or from the more comprehensive point of view which I have endeavoured to take up, it cannot be doubted that in the future there will be, from time to time, large alterations in the volume and distribution of this trade. The more important factors of this redistribution will be: (1) the extension of fibre-manufacturing industries in the Colonies; and (2) changes in the aggregate, but still more in the relative consumption of the raw materials.

A.—MISCELLANEOUS VEGETABLE FIBRES.—STATISTICS OF IMPORTATION INTO THE UNITED KINGDOM, YEAR 1885.

	FOREIGN COUNTRIES.				BRITISH POSSESSIONS.			
	Russia.	Belgium.		Total.	Australia.	East Indies.		Total.
Flax — Dressed fibre and straw	1,884,399	687,498		2,854,064	1,734	...		1,734
Flax — Tow and waste	205,452	94,903		338,470	...	29		29
	Italy.	Russia.	Germany.					
Hemp — Dressed or undressed	377,124	346,367	312,389	1,046,003	—	—		—
Hemp — Tow and waste	18,524	33,162	42,974	95,858	—	—		—
	Philippine I.	U. S. America.			East Indies.	Straits Settlements.		
* Hemp substitutes	664,565	49,835		778,611	71,004	119,969		291,310
	U. S. America.	Mexico.			East Indies.	Mauritius.		
† Unenumerated fibres	51,520	20,420		86,951	16,291	6,342		23,370
						East Indies.		
	France.	Belgium.				Bombay. Madras.	Bengal.	
‡ Jute	1,792	1,177		5,063		1,285 2,305	3,232,139	3,235,733
Paper-making. Linen and cotton rags	Germany. 207,909	Belgium. 84,569		460,936	Channel I. 4,289	Australasia. 765		5,992
Paper-making. Esparto	Tripoli. 307,081	Algeria. 418,880		1,149,415	—	—		—
Paper-making. Other materials. Half stuff and wood pulp	Norway. 277,698	Belgium. 73,903		631,199	East Indies. 7,579	...		9,271
			Total	£7,446,570		Total		£3,577,439
	Russia.	France.			East Indies.	Ceylon.		
Cordage and twine cable yarn	64,548	64,007		188,058	197,576	63,163		262,334
				£7,634,628				£3,839,773

NOTES.—In this table the imports are specified only from the two or three more important countries in which the particular fibre is produced. The totals are the aggregate importation from all foreign countries or British possessions respectively.

The returns from which these statistics are compiled, are complicated by two circumstances—(1) "Trivial" names used to designate certain fibres, *e.g.* the term Hemp applied to Manilla, Sisal, and the like; and (2) "Indirect Importation," *i.e.* returns of trades in fibre with countries other than those in which they are produced. However, these complications, it is easy to see by inspection of the complete returns, do not really obscure the main lines of trade which lie directly with the producing countries.

* Included under Hemp, but the countries whence imported indicate Manilla, Sisal, and the like.

† Described as applicable to same uses as Flax or Hemp.

‡ In addition to the raw fibre there is an importation of yarn to the value of £[illegible], of which £[illegible] is from France.

B.—Some Statistics of Exports of Paper, Linen, and Cordage to British Possessions in 1885.

	Value in £ sterling.		
	Paper.	Linen.	Cordage.
Bombay	83,514	25,888	—
Madras	25,381	—	—
Bengal	49,444	45,219	—
Straits Settlements	—	10,197	—
Ceylon	13,254	1,347	—
Hong Kong	—	13,271	—
West Australia	3,572	3,501	—
South Australia	67,414	35,575	11,015
Victoria	251,996	160,532	26,196
New South Wales	254,500	171,394	27,400
Queensland	60,904	53,327	—
Tasmania	16,117	4,907	3,107
New Zealand	121,013	60,379	14,272
Natal	13,244	9,609	4,302
Cape of Good Hope	38,887	17,673	—
Mauritius	4,323	2,442	—
West Indies	13,077	31,758	11,419
British Guiana	4,760	8,774	4,998
Canada	71,010	124,401	8,179
Newfoundland and Labrador	5,024	5,594	6,493

There is no possibility of foreseeing, with the aid of science, the changes and developments of the first order; we can only anticipate the *general* tendency of progress in the Colonies from the one-sided commerce of early days, when trade is based on raw materials exported and manufactured goods imported, to the all-round activity of later days, which is influenced as much by the more complicated laws of *general* exchange, as by the special local features which exclusively moulded the earlier commerce.

How this progressive movement will affect the reciprocal relations of Colonies and mother-country in regard to this particular trade, I leave to others to determine. The causes included under (2) are easier of measurement. I have endeavoured to illustrate, as the particular occasions arose, the application of a purely laboratory method to the valuation of a new fibre—this valuation resting upon the ultimate constitution of the fibre as revealed by investigation, on the one hand; and the comparison of this on the other hand, with standards taken from parallel investigation of the fibres which now rule the market. On the basis of this comparison I have shown, for instance, that the "native hemp" from Natal will compete in the flax class; Sida will compete with jute; the West Indian "Gru-Gru," as an exceptionally fine monocotyledonous fibre, is capable of applications of a higher order than is usual with fibres of this class, for which it may even come into competition with hemp. Phormium fibre, I have shown, is susceptible of "refinement," by selection and chemical treatment, and when so modified may compete with the dicotyledonous fibres in certain applications. In the paper-making class I have shown the value of certain bast tissues and residues of monocotyledonous plants as raw materials.

In all these cases I have necessarily ignored the first commercial condition, *i.e.* cost of production, having no data at hand upon which it could be estimated. For these we must look to future investigation in the several localities where the raw materials in question have been, and, on a favourable estimate, are to be produced.

Given this, and the results of a full laboratory investigation of a specimen in a fair condition, and it is not difficult to forecast the probable future of the fibre. It may be objected to this statement that many predictions of commercial success, also based upon methodical investigation, have been falsified by results. The only reply to this is that the method upon which this report is founded is the outcome of recent investigations and a critical examination of antecedent publications on the subject, from which whatever appeared valuable has been selected and retained. Like all others, it must be judged by its fruits. If it is to justify itself, it must condemn the unprofitable as it must assign a place in commerce to the useful.

In conclusion, I have the pleasure to acknowledge the substantial help of those who have been associated with me in the work of investigation: my partner Mr. E. J. Bevan; Mr. C. M. King, who has done the whole of the microscopic preparations; and Mr. C. Beadle (of Messrs. Joynson), who has done the greater part of the chemical analyses. This report is, in fact, the product of our joint labours.

I have also to thank Dr. Watt of the Indian Section, Mr. McCarthy of the West Indian Section, and Mr. P. L. Simmonds of the New Zealand Section, in addition to those gentlemen whose names have been previously mentioned for many suggestions and much kind assistance.

LEATHER, LEATHER GOODS, FURS, HIDES, AND TANNING MATERIALS.

By JAMES POWELL.

AMONGST the various descriptions of leather and leather goods, hides, tanning materials and furs, displayed at the Exhibition, those chiefly affecting the industries of the United Kingdom, from a commercial point of view, are the exhibits of tanned leather. These Colonial leathers for a considerable time past have been staple articles in the home boot and shoe trade; and their use has rendered great assistance to those industries, enabling England to attain that important position, as an exporter of leather-manufactured articles, which she has now reached.

The specimens of tanning materials shown were, in most cases, such as are regularly used in considerable quantities by English tanners, and the use of which is necessary to enable them to produce leather sufficiently cheaply. These materials are much stronger and quicker tanning agents than the home-grown English oak bark, which is very slow in its action; and restricted to its use alone, the home tanners would be unable to compete in price with Australian and Canadian leather.

Australia, the Cape, Singapore, India and the West Indies form a large source which supplies England (and especially London, the chief dépôt of the world) with raw hides and skins; there were, however, only a few exhibits of raw hides in the Exhibition, those shown being from Australia and West Africa.

LEATHER.

AUSTRALIA.—NEW ZEALAND.—CANADA.

Although there was ample variety of leather shown from the Colonies, there was very little possessing any special novelty, or with which the leather trade generally is not well acquainted. Most of the exhibits, therefore, had the advantage of being genuine specimens of Colonial production, which can be supplied in quantities, and are more or less suitable to be worked up by home manufacturers.

In comparing Australian and New Zealand with Canadian sole leather, it is evident that the general character of the two former is substantially the same, whilst differing very considerably from that which is produced in Canada. This is owing chiefly to the tanning material employed, each country making use of its native bark as the foundation of its tanning agent.

The difference in quality is also owing to the methods of preparing the hide before the tanning process is begun, the Canadians practising the "sweating" process, and the Australians and New Zealanders the "liming" process. One effect of this is, that the Canadians produce a greater weight of leather from a hide than the Australians. The Canadian leather is

tanned chiefly with hemlock bark, and is quite equal to the leather tanned in the United States. It is harder, more solid, offers a greater resistance to wet, and possesses better wearing qualities than any leather that is tanned. It is, however, very fleshy and "heavy weighing"; it is also darker and redder in colour than Australian and New Zealand leather, the best of which now is almost as bright as, and competes very closely with, good English tannages. The grain, however, is rather brittle and the leather difficult to work, and has consequently to be used almost exclusively for common nailed work. Most of the exhibits are badly fleshed, and an improvement in this direction is desirable.

The principal tanning agent used in Australian and New Zealand leather is mimosa, or as it is commonly called in the Colonies, "wattle" bark. This grows in very great quantities, although slightly restricted of late, and it has been found prudent and necessary to lay out plantations of mimosa shrubs in many districts, in order to ensure the continuance of the supply sufficient both for their own consumption and for the requirements of the English market.

In these Colonies also myrabolanes (a tanning material grown largely in India) and valonea (Turkish oak), have been freely used, and when judiciously employed in a certain proportion with the mimosa bark considerably improve the quality of the leather, and make it better colour and firmer, and consequently more marketable and more valuable. It should be here remarked that mimosa bark always gives the leather tanned with it a more or less pinkish or reddish colour, which for the English market should be got rid of as much as possible. The use of some other material mixed with the bark, such as bright myrabolanes, helps much to counteract this colour. The leather of Australia and New Zealand, as mentioned above, is not so solid as that of Canada. On the other hand, it is, however, much more "cleanly fleshed," "lighter weighing," more pliable, and more easily sewn, and therefore more adaptable for some purposes.

The best Victorian and New Zealand tannages also have now a particularly bright colour, and the leather when used for soles of boots competes very closely in finish with good English tannages. One very noticeable feature about the Australian tannages is the strongly marked difference between the sole leather produced in the Colonies of Victoria and New South Wales: that of Victoria being in every case much more "cleanly fleshed," of brighter colour, and especially better finished than that tanned in New South Wales (tanned chiefly in or around Sydney); the Sydney leather is always more fleshy, of darker colour, more roughly finished, and only suitable for a commoner class of work. The New Zealand leather partakes more of the character of the Victorian tannages, and possesses the extra advantage of being tanned from stouter pelts, the New Zealand hides being much better grown, more compact, and of smaller pattern than Melbourne hides.

Some Australian tanners have experimented by using cheap extracts, the effect on the leather being very deleterious, as it spoils the colour, which is now the first and most important consideration for the English market. Others have very freely used glucose, in order to add weight to the leather. This is very detrimental, offering no advantage to the tanner, as he loses in price considerably more than he gains in weight. A report on the Australian tanned and curried leather would be very in-

complete without special mention of the Kangaroo and Wallaby skins, of which there were a few on show. The exports of these have been very restricted of late years : formerly they used to come in much larger quantities. These animals are no doubt decreasing in number, and what are left are being driven further inland, and are consequently more difficult and expensive to procure. The peculiarity of these skins, however, is that they are particularly tough and strong for their substance (very much like porpoise hides in this respect), and when tanned and well curried they are fit for strong light boots, and give a fine grain and finish. They are also very useful for making laces. These skins, however, are not properly appreciated in England at the prices they should bring to make it worth while for the Colonies to export them in larger quantity.

There is one point, however, that is a chronic and great defect in Australian and New Zealand leather: viz. the flaying is generally very defective. The butchers do not use sufficient care in taking off the hides. There seems no remedy forthcoming to cure this fault. It is a very important point, and one which with a little determination could doubtless be amended.

In England there is a system in some districts of paying the man who takes off the hides sixpence for every one that comes in well flayed. Sixpence extra per hide spent in this way is well laid out. That the flaying can be done better is clearly shown by the way meat-preserving companies' hides are treated in this respect, large quantities of which are sent here, and always bring a higher price than others on account of the better flaying. The Canadians pay much more attention to this point.

Another fault which stands out conspicuously in all Australian, and to almost a similar extent in Canadian leather, is the branding of the hides, many being heavily branded, and generally on the butt, the best portion of the hide, spoiling the primest part. This, of course, interferes very much with the leather being used economically. Under the present conditions of cattle-rearing, branding the hides is probably a necessity, but care might surely be taken to injure them as little as possible by branding in a less important part. Marking the horns or hoofs would obviate this difficulty; this method, however, is open to the objection that such marks could be easily removed by any one feloniously disposed.

Next to the Colonial sole leather, the most important exhibits were those of upper leather, consisting chiefly of "satin" and "waxed splits," in the supply of which for the English market the Canadians hold the field over the other Colonies. The Canadian satin leather is well split, well tanned and curried, and has a fine surface. The tannage, however, is a little hard for currying purposes, and the leather is generally too heavily stuffed : these grain-splits are only fit for heavy boots, and do not compete with the work for which best French and English calf is used, but at the same time is better in appearance and quite equal for wear to the English Cordovan hides.

The Canadian "waxed splits" are similarly dressed to the above, but have not such a fine surface, are not so durable, and are more porous than the satin. They are consequently only fit for still rougher and heavier purposes. The exhibits of "satin" (buff) and "waxed splits" of Messrs. P. Ralston and Sons, of Montreal, and Messrs. Duclos and Payan, of St. Hyacinthe, bear off the palm.

There were some "satin" and "waxed splits" of Australian manufacture shown which were well got up, well tanned, and well curried, but they were mostly oversized, and had not travelled very well, the leather having spued in transit. The leather had, however, the advantage of being softer and more supple than the Canadian curried leather, and if it could be produced to compete in price with Canadian "satins" and "splits," and as carefully packed, so as to arrive in good condition, a large trade could no doubt be done in these goods by the Australian and New Zealand tanners and curriers.

The Canadian glove hides for better boots and shoes were fine and firm, and quite equal to anything that the United States have ever exported to this country. The Canadian coloured skins, on the other hand, were poor, and not at all equal to those manufactured in Europe, nor could they compete with French-dressed Algerian skins.

With regard to basils (tanned sheep), the Canadians were only fairly tanned and got up, and were very inferior to the Australian and New Zealand productions. The Canadians were wanting in evenness of colour and soundness of grain, in freedom from grease, and in general appearance, sightliness and finish. In all these points the best Australian and New Zealand tanned basils are superior to the best Canadians, both as regards the soft-tanned basils for dressing and colouring purposes, and also in the "set-out" and "strained" basils for lining and other uses.

The waxed calf-skins also shown in the Canadian section were inferior to those of Sydney and Melbourne tanners. Those tanned by the latter are much finer and more supple than the Canadians, although neither are equal to the calf of French, German, or English manufacture and dressing, and unless considerably improved in the currying would probably not pay to export.

There were some remarkably fine specimens of Canadian japanned and enamelled hides and sides, the leather of which was soft, pliable, and very suitably tanned for the purpose; the japanning and enamelling processes were well done. These remarks apply both to the large hides for carriage purposes, and to the smaller hides for shoe-tipping. There was also some japanned and enamelled leather of Australian manufacture for shoe purposes of quite equal merit.

There was some good leather for harness of Australian manufacture consisting of black and stained harness backs, stirrup backs, rein backs, strap backs, &c., and bag leather. The best of these were well rounded, clean fleshed, evenly shaved, well tanned, and well curried, and would compete as far as quality is concerned very favourably with the average English productions of these articles, if the prices could also be brought into comparison. The Canadian harness leather shown was much rougher and coarser, and only fit for country work.

CAPE OF GOOD HOPE.—NATAL.

In the Cape of Good Hope leather exhibit there was only one show sent by the Cape Commission, tanned and curried by Messrs. Mossop and Garland. With the exception of the sole leather, the other exhibits shown were of very superior quality, and were tanned with native mimosa bark,

from native hides, from calf, goat, sheep, kip, and ox and cow hides. One very noticeable point in all the Cape leather is that it is very well flayed.

The goat and calf skins and coloured moroccos were of prime quality, and nearly equal to French manufacture.

The harness and strap leather, too, was generally very good in colour, flaying, tanning, and currying. The stained harness leather was too dark however, and wanting both in lightness and evenness of colour. There were examples also of brown and black backs.

The waxed calf and kips were well got up, but wanting in fineness of grain. The levant, waxed splits, memel and grain hides, satin hides and calf, bag hides (with smooth russet, buffed, stained, and round grain) were all well tanned, curried, and finished, and did the Colony great credit. There were also some well-prepared and coloured moroccos, suitable for shoe and book-binders' work, well-tanned and evenly coloured, but as yet not equal to European goods.

There were some good tanned basils also shown; these, however, would have been better if they had been more "struck out" in the grain, and they should have been freer from grease. Mention must also be made of the Cape alum-tanned leather, of which a specimen in harness was shown. It was particularly tough, strong, and durable, and although possessing very little attraction in point of finish and style, would be fit for, and able to withstand, very rough work and usage. The sole leather was the weak part of this exhibit. It was dark in colour, soft, insufficiently struck and rolled, and wanting in firmness, solidity, substance and finish.

Natal exhibited but a few hides of sole leather, tanned with African mimosa. They were firm and clean, and, though darker than Australians, were equal in appearance to Canadians; if they can only be imported into this country at a similar price, they will find a large market. This Colony has never exported any material quantity.

Imports from Colonies.

The following statistics will be interesting in showing the importance of the skins and leather from our several Colonies. The imports of the last five years are given in each case:—

Australia.

Imports of the last five years of—

Leather	336,044 cwts.
Basils	113,244 cwts.
Hides (mostly salted)	720,665 hides.
Mimosa Bark	36,067 tons.

West Indies.

Hides (chiefly dry)	60,428 hides.

Cape.

Hides (salted and dry)	1,745,082 hides.
Kips and Skins	88,791 do.

Mauritius and Madagascar.

Hides	125,888 hides.

SINGAPORE, MANILLA, AND BATAVIA.

Buffalo Hides	744,395 hides.

INDIA.

East India Kips	28,582,715 hides.
Bombay, Kurrachee, and Calcutta Buffalos . .	721,622 hides.
Myrabolanes	53,587 tons.
Terra Japonica (Gambier)	73,948 tons.

Of Canadian statistics there are none kept. It is difficult to discriminate between the imports from this Colony and those from the United States.

WEST AFRICA.

There were only two exhibits of any commercial value in this section, shown by the Lagos Government: one of tanned sheep skins, and the other of yellow-stained sheep skins. These were both very poor leather, wanting in toughness, although of fair colour, and not of much value.

The chief exhibits were interesting only as curiosities, being specimens of native ornamental riding boots, satchels, bags, leggings, couriers' bags, sword and dagger sheaths, hat trimmings, war implements, skin water-bottles, sandals, pouches, hunting bags, writing cases, and reins, and other horse trappings: all crude and rough, and of no commercial value.

There were also similar exhibits from Gambia district and Sierra Leone, the latter showing also specimens of native skins—ox, alligator, goat, deer, leopard, seal, and wild cat.

The Gold Coast showed similar leather articles, and also leopard and monkey skins.

NOTES ON INDIVIDUAL LEATHER EXHIBITS.

CANADA.

BELMONT TANNING CO., Victoria, British Columbia. Sole Leather Hides and Sides.—Hemlock tanned, firm leather, fleshy, darkish colour, well finished, fairly flayed.

LOUIS, BREITHAUPT, AND CO., Berlin, Ontario. Sole Leather Sides.—Hemlock tanned, firm solid leather, darkish colour, fleshy, fairly flayed, well finished. Black Harness Hides.—Well tanned (lighter tannage than sole leather), and well curried; tallow and oil-dressed; well trimmed, but not closely rounded; wanting in firmness; grain fairly got out; not so fine on grain or in finish when compared with the English. Waxed Kip Sides.—Similar tanning and currying, fairly trimmed; rather coarse flesh; fair colour on grain, no brands. Waxed Calf.—Similar to above in tanning and currying, also coarse flesh; would not compare with French, German, and English manufacture.

A. R. CLARK AND CO., Toronto, Ontario. Specimens of Coloured Moroccos and Skivers (13 different colours) from goat, calf, and sheep skins, only fairly got up; not equal to European manufactures. Tanned Basils.—Only fair colour, soft tanned, many low grain, wanting in evenness of colour and finish.

DUCLOS AND PAYAN, St. Hyacinthe. Satin (buff) and Waxed Splits.—Well done, and fine surface well finished.

DRUMMONDVILLE TANNERY (SHAW BROS. AND CASSILS), Montreal, Quebec. Sole Leather Sides.—Hemlock tanned, firm leather; wanting in brightness of colour, but better in this respect than the average American side.

GOURDEAUX FELIX, St. Roche, Quebec. Black Glazed Goat, Black Japanned Sides, Purple Glazed Split Side, Brown Shoe Split Side, Brown Imitation Crocodile from ox hide, Pebble Grain Side, Satin Grain Side.—All very fairly got up and finished, but inferior to European manufacture.

GUAY DESIRÉ, Quebec. Waxed Satin and Flesh Sides, Pebbled and Levant Sides. —All made from split ox and cow hides, well tanned and curried; tanned with hemlock and oak bark; also some Levant goat, all well got up and finished.

W. HEATHORN, Victoria, British Columbia. Sole Leather Sides.—Two tannages, one very red, the other lighter in colour; firm leather, but fleshy. Black Harness Sides.—Rather roughly got up, compared with European manufactures, wanting in appearance and finish. Waxed Splits.—Fairly split and curried; fairly fine face.

JOHNSON AND MAGIRL, Victoria, British Columbia. Sole Leather Side.—Fair quality Canadian leather, darkish colour, firm. Black Harness Side.—Well tanned and fairly curried, well trimmed.

MONTREAL CARRIAGE CO. Coloured and Split Hides (Imitation Moroccos).—For lining carriages and upholsterers' work; well got up and evenly coloured; various colours, large selected hides. Japanned and Enamelled Hides.—Light tannage; very fine large hides; the process was well done; the leather is pliable and the enamel tough.

A. PION AND CO., Quebec. Prepared Calf and Sheep Skins.—Consisting of calf, shoe and glove kid, glazed sheep and calf. Some hemlock and others sumach tanned; all fairly-well tanned, softened and finished, but not equal in quality to European manufacture.

PETER RALSTON AND SONS, Montreal, Quebec. Satin Sides.—Hemlock tanned, well tanned and curried, well got up and finished, fine surface on grain. Waxed Fleshes.—Similar, but not so fine on face.

C. ROCHETTE, Quebec. Satin and Glazed Sides.—All very well tanned and curried, good colour on flesh, fairly fine grain and finish.

ROBERT WHITE AND CO., Montreal, Quebec. Boot and Shoe Stiffeners (See Boot Report, Leather Board).—Made of leather pieces and hemp reduced to a pulp, and then spread out and dried, fairly tough when dry.

WINDSOR TANNING CO. Sole Leather Sides.—Light colour for Canadian tannage, firm, solid and well finished; also another tannage, similar, but darker in colour. Waxed Split Sides.—Hemlock tanned, fairly curried, rather coarse flesh; another lighter-coloured tannage, but otherwise similar.

MILLER'S EXTRACT CO. A number of samples of Canadian extracts from hemlocks were shown; these are exported in large quantities to this country, the idea being to save cost of freight and other expenses on the waste of the bark, by making the extract where it is found. Samples of leather purporting to have been tanned with these were also shown. These were tanned in this country, and were very well-tanned serviceable samples.

NEW SOUTH WALES.

A. E. ARNOLD, Marrickville. Compressed Leather.—Very well made, hard and tough, and possesses great wearing qualities, very useful for some purposes, such as emery wheels, brake blocks, &c.

BEGG AND SON, Sydney. Sole Leather.—Dark colour, tanned from rather coarse hides, firm solid leather, fleshy and rather cut, insufficiently struck, roughly finished.

JABEZ CARR, South Dubbo. Sole Leather.—Firm dark leather, fleshy, fairly flayed, roughly finished. Harness Leather.—Well tanned and curried, but very discoloured, mostly well flayed.

A. R. CRAWFORD, Meona Plains, Walcha. Halters and Hobbles.—Made from plaited green hides, rough and serviceable, but of no commercial value in England.

DAVENPORT AND SONS, Sydney. Sole Leather Sides.—Firm, well-tanned solid leather, dark colour, fleshy, fairly struck out on grain, fairly flayed and lightly branded. Tanned Lining Basils.—Only fair colour; well tanned; untrimmed and ragged on edges, insufficiently set out and rather low grain. Enamelled and Japanned Kangaroo and Calf Skins and Splits.—Well tanned for the purpose, supple, pliant leather; the enamelling and japanning process very well done. Waxed and Russet Kip

and Calf, Kangaroo, Satin and Waxed Splits.—All well tanned, curried and finished; wanting in fineness of surface when compared with French, German and English goods. This was doubtless owing very much to the Australian pelts being coarser than European.

FARLEIGH, NETTHEIM AND CO., Sydney. Sole Leather Sides.—Good colour for Sydney leather, very stout, good pelts, well tanned, firm and solid, well finished, rather fleshy, well flayed. (This was the best sole leather exhibit from New South Wales.)

FORSYTHE AND SON, Sydney. Sole Leather Sides.—Dark colour, well tanned, firm leather, rather fleshy, insufficiently struck and finished in offal, fairly flayed, rather heavily branded, wanting in finish.

HARRISON AND WHIFFEN, Sydney. Sole Leather Sides.—Dark and very irregular colour, firm leather, fleshy, roughly finished, fairly flayed, rather branded. The extract-finished sides are no improvement on the mimosa tanned. Waxed and Russet Kangaroo and Kip Buff Leather.—Well tanned and curried, tough leather, fairly finished, but wanting in fineness of surface.

GEORGE HAYWARD. Tanned Basils.—Fair colour, well tanned, rather fleshy, insufficiently set out.

J. C. LUDOVICI, Brickfield Hill. Leather Belting and Hydraulic Leather.—Well-tanned leather, some fair colour, others dark, various tannages, well dressed; leather belting, strongly, but not so neatly made as the English.

G. A. THOMSON, Kelso. Sole Leather Sides.—Firm, well tanned, darkish colour, fleshy, wanting in finish, fairly flayed. Harness Leather.—Brown: Well tanned and curried, fair colour. Black: Very discoloured. Bag Leather.—Fair colour and well got up. Waxed Calf Kip and Wallaby.—Well tanned and curried, but wanting in fineness of flesh.

WALSH, ELLIOT AND CO., Sydney. Sole Leather Sides.—There appeared to be two tannages, very similar except that one is darker than the other; both, however, were rather dull and irregular in colour, well tanned, mostly firm, fairly flayed, wanting in finish, mostly branded, rather fleshy. Harness Leather.—This firm showed some very good specimens of dressed harness leather, unquestionably the best of this class exhibited from any of the Colonies, consisting of black and russet harness, trace, rein, stirrup, bridle, belt, strap, and bag leather. These were all good colour, very well and finely curried, well fleshed, evenly shaved from well-flayed hides, well rounded, all deserving of great commendation, and competing closely in quality with similar articles of English manufacture. The stained bag leather was well split and carefully stained a bright yellow colour. Upper Leather.—The waxed calf kips, grain, tweed (satin), were also equally well tanned, curried, and carefully finished. Basils.—The basils also, tanned by this firm, were especially worthy of mention, being bright even colour, well sleeked out in the grain, spreading pattern well finished, and in every way suitable for the European market. This firm showed the best quality of this class of basil in the Exhibition, illustrating especially the great superiority of Australian tanned basils over those from Canada.

VICTORIA.

J. H. ABBOTT AND CO., Sandhurst. Sole Leather Sides.—Well-finished leather, clean-fleshed; about 30 per cent. branded; irregularly flayed, some well flayed, others rather cut; some sides fairly good colour, but wanting in regularity in this respect, some being spotty; fairly firm for most part, but some mild texture. Upper Leather—Waxed Calf.—Good colour on grain, fairly fine flesh, well curried, not well flayed. Waxed Kip Sides (shoe slitters).—Good colour on grain; well tanned and curried; fairly trimmed; unbranded; wanting in fineness of flesh; rather offally. Above are coarser on flesh than English or East India tanned kips. Satin Buff Sides.—Well split, curried and rounded; fine grain; well finished; have not curried well, the oil having "spued." Waxed Splits.—Well-rounded butt splits; well split, tanned and curried, well flayed. Waxed Kip Backs.—Well tanned and curried, fairly rounded, coarse flesh. Russet Brown Kip Bellies.—Well curried and trimmed, light and clean. Rough-tanned Splits.—Splits from backs well rounded, good colour, well flayed, rather coarsely split, would require shaving before being blacked; useful for making upper leather for common shoes, if well got up and well curried. Harness Leather.—Black Harness Sides, 1st quality: Fairly tanned and curried, but rather spongy in offal, well blacked on grain, fairly clean flesh and flaying, rather coarse on grain, firm, good substance. 2nd quality: Similar, but not so firm, and poorer substance. Stained Bridle Leather.—Well tanned, curried and stained, fairly rounded, clean, well flayed. Brown Bridle Leather.—Similar

to above, but not stained, fair pale colour. Belt or Strap Leather (brown harness sides). —Dark colour and spotty; half-branded well-grown hides, but coarse texture and flesh; loose offal; fairly trimmed; heavily stuffed. Tanned Dugong (Australian Hippopotamus Hide).—Insufficiently tanned; a curiosity, no commercial value.

GEORGE CUNNACK, Castlemaine. Sole leather Sides. — Very well tanned; firm, solid leather; some not well flayed; many branded; some very good colour, others not so bright. (This is the best Colonial sole leather that was exhibited.)

JAMES B. HAYMAN. Sole Leather Sides.—Well-tanned leather, fairly firm, some mild, rather baggy hides, only fair colour, many rather stainey, many ill-flayed, wanting in finish. Crop Butts.—Similar to above, but not wisely or evenly rounded; darker colour than the sole sides. Upper Leather—Waxed Calf.—Well tanned, curried and trimmed; good colour on grain, rather loose in offal, well flayed, unbranded, fairly fine grain for Australian pelts. Waxed Kip Sides.—Similar to above, but not so fine a grain. Wallaby Skins.—Well tanned and curried, tough leather, slightly trimmed, rather loose flesh. Rough-tanned Basils. — Fair pale colour; fleshy; good spreading pelts; some low grain. Harness Leather—Black Harness and Rein Backs.—Well tanned and curried, cleanly shaved, well-grown and level hides (for Australian); well rounded both in offal and shoulders. Black Harness Hides.—Similar to above, but only trimmed (not rounded). Stained Bridle Butts (stirrup butts and stirrup sides).—Well tanned and curried, well flayed, good level pelts, mostly well stained. Brown and Stained Bag Hides and Sides.—Split hides, well got up, but not suitable for the purpose, as grain is too imperfect. Skirt sides.—Large level sides, fair pale colour, well flayed and well shaved, prepared with very little grease.

J. M. BARRY, Omeo. Rough-tanned Kips.—Dull colour, very fleshy, fairly flayed, well tanned. Rough-tanned Sole Leather Sides. — Dull colour, rather fleshy, fairly flayed, wanting in firmness and finish. Rough-tanned Kangaroo and Wallaby.—Well tanned and slightly curried, tough leather, good grain. Waxed Kip Leather.—This was in bad condition through the oil having "spued."

JACKSON AND BREARLEY, Bairnsdale. Sole Leather Sides.—Clean, well-fleshed and well-finished leather; most well flayed; firm leather; good colour.

MICHAELIS, HALLENSTEIN AND CO. Sole Leather Sides. — Well-tanned firm leather, fairly flayed, well finished, clean, fleshy, fairly good colour, not heavily branded.

PENAL DEPARTMENT OF VICTORIA. Waxed Kip Calf and Kangaroo. — Only fairly tanned and curried, but very loose grain; wanting in finish; some blacked on grain, and some on flesh.

QUEENSLAND.

QUEENSLAND COMMISSIONERS. Dugong Hide.—Coarse, ugly, roughly-tanned leather, no commercial value, not thick enough for emery wheels.

Black Harness Sides, Brown Harness Sides.—Fairly-well tanned and curried, rather loose in offal, wanting in firmness, fineness on grain and finish, well flayed and fair flesh. Stained Bridle Sides.—Similar leather to above, rather foxy-coloured stain, should be much brighter and more yellow. Brown Bridle Sides.—Similar, but brown, not stained, too dull in colour. One Satin Tweed Side.—Fairly-tanned and curried, badly sized, wanting in fineness on grain, poor colour. Tanned and Curried Kangaroo.—Similar leather and currying to above; wanting in finish and fineness of grain. Waxed Kip Side.—Coarse on flesh, dark colour on grain; wanting in finish.

WILLIAM STEPHENS, Brisbane. One Tanned Sole Leather Side.—Dark colour, fleshy, branded, roughly finished, fairly firm and fairly flayed. The curried leather of this tanner was fairly tanned, reddish and uneven in colour, fairly trimmed. Kangaroos wanting in fineness and finish.

WESTERN AUSTRALIA.

VICTORIAN TANNERY, Geraldton. No. 47. One Tanned Bull Side.—Red colour, poor tannage, soft, fairly flayed, roughly finished. One Waxed Kip Side.—Poor tannage, exceedingly coarse on flesh, too heavily sized. One Brown Harness Side, one Black Harness Side.—Poor tannage, wanting in firmness, loose leather, not well curried, very coarse grain. Black side too heavily sized.

No. 56. C. S. MENGER, Newcastle. Tanned and Curried Kangaroos.—Poor tannage, not well curried, fair colour on flesh, not well trimmed, wanting in fineness on grain and finish.

NEW ZEALAND.

LIGHTRAND, ALLAN AND CO., Christchurch. Sole Leather Sides.—Good well-tanned leather, fairly firm, some good colour, but rather irregular in this respect, slightly fleshy, many not well flayed, lightly branded, fairly finished. Tanned Basils. —Soft tanned basils, good colour, fair grain, rather fleshy, mostly slightly greasy. These are by far the best exhibits of colonial soft-tanned basils displayed.

MICHAELIS, HALLENSTEIN AND FARQUAHAR, Dunedin. Mostly good colour, some bright, well finished, firm, clean leather; not well flayed.

BOOTS AND SHOES.

For the following report on the boots and shoes shown at the Exhibition, I am indebted to Mr. W. Haldinstein, of the firm of P. Haldinstein and Sons, who reports as follows :—

The CANADIAN section showed a greater variety of wholesale manufactures than any of the other sections.

The most striking case of goods was that of Messrs. L. Cote and Brother, of St. Hyacinthe. These consisted of a regular assortment of children's, boys', and men's goods, all being made exactly after the same model and made entirely from Canadian leather; the uppers being of wax split kip, and satin and grained hide, and the soles from native hemlock sides. They were all pegged by machinery, and comparing them with English manufacture were wanting in taste and style.

Messrs. Fogarty and Brother, of Montreal, showed a very large collection of children's and women's sewn goods; many were cut from what the Canadians call polished calf and buff, leather almost unknown here. The children's boots were chiefly cut from maroon- and russet-coloured goats. Most of the boots were in good taste, but of little use in England, coloured boots not being worn here, except a few buff in summer for the seaside. The uppers are made chiefly from European leather. The boots are inferior to English manufacture in finish and neatness of make.

Messrs. Orr Harvey and Co., of Hamilton, had a serviceable and varied collection, got up very creditably, of men's, women's, girl's, boys' and infants' boots and shoes. With the exception of the boys' boots they were too thin in the sole. The boots had riveted soles, and were otherwise nicely made.

Messrs. J. and T. Bell, of Montreal, showed a collection of what they call fine shoes, consisting of ladies' boots and shoes, very well finished and neatly got up. The ladies' glove and glacé sew-round shoes were exceptionably well made with half military, some leather, and some wood heels; but the colour of the linings were unsuitable, and the bows not sufficiently stylish for such high-priced goods, ranging, as they did, from 5*s.* to 9*s.* per pair. Some had uppers of French or German manufacture, others, of rougher make, of native levant leather; the soles generally were too thin.

The Amhurst (Nova Scotia) Boot and Shoe Manufacturing Co.'s exhibit consisted chiefly of gentlemen's Balmoral, button, and elastic boots. These are hand-made, and fitted for the bespoke trade only.

W. Heathorn, of Victoria, British Columbia, had a very large assortment of boots: the best amongst them was a man's hide Derby shooting-boot, with cork rand; this well deserved notice; the others had the appearance of country-made goods, roughly got up; riveted soles, many with nuggeted nails, square toes, and old-fashioned in style.

Messrs. Dack and Sons, of Toronto, showed a small collection, ten pairs of gentlemen's fine bespoke boots and shoes, averaging 33*s.* per pair; they were cut principally from European leather, all hand-made, and only such as a first-class retail shoemaker could get up.

The Berlin Felt Boot Co., Berlin, Ontario, showed a single pair of men's, very rough, short Wellingtons; the peculiarity was that they were made on a blocked felt stocking as a lining $\frac{3}{8}$ of an inch thick, coming to the knee when on; these were only fit for woodmen and farmers in a very cold climate.

Thompson and Co., of Montreal, exhibited a large case of ladies' dress and fancy shoes, very effective, and stylish; but the trimmings, beading and embroidery, which gave the goods the smart appearance they certainly did possess, were either English or French manufacture, and the glacé kid, from which they were principally cut, and the wood-covered heels, were French, and the sole leather English.

Messrs. Renfrew and Co., Quebec, in their fur department, showed a real seal and otter house-shoe lined with satin, and very beautifully bound with beaver, price 42*s.* per pair; also some moccasins made by Indians of deer skin, and a handsome pair of men's hand-sewn Wellingtons with natural moose-deer tops, trimmed with beaver for driving, never used in this country.

Robert White and Co., of Montreal, exhibited a large quantity of pressed leather stiffenings or counters; these were strong, firm, and waterproof, and if the prices are reasonable, would sell well in England.

The Canadian Rubber Co., of Montreal, showed some splendid samples of rubber sole, canvas top Plimsoll shoes; these were much lighter, better coloured and better finished than British-manufactured goods, and if only the prices can compete with Europe, there is a big market for them here, competition is not large, as there is only one factory of these goods each in England, Scotland and France, and two in Germany—all managed by Americans. The fishing, mining, Napoleon, and Wellington boots had much the appearance of leather, having dull tops and bright vamps. There was also a good collection of over-shoes, boots, &c. These goods were not priced, but, if only reasonable, a very large trade could be done here.

In the NEW SOUTH WALES COURT there was only one exhibit by Messrs. Davenport and Sons, of Sydney, consisting of a useful set of samples for the general trade; chiefly men's and boys' boots, Balmorals and elastic sides, and shooting boots, made of European leather. These were very well made, being almost equal to English manufacture.

VICTORIA had three cases of first-class handsome boots of exceptional merit, better could not be produced by the finest makers in the West-end of London; many pairs were good enough to be kept in glass cases as specimens of what can be made. The exhibitors were Paul Thomas, J. M. Kelly, and George Jefferies, all of Melbourne, and the difficulty was to tell whose collection was the best. There were fine specimens of jockey boots, patent

Wellingtons, shooting boots, patent dress, Napoleons, and ladies' glacé kid boots, also some very well made racquet shoes. The leather used was evidently all European.

The Government exhibits, from the Penal Department of Victoria, five pairs only, made for the Colonial service, were made from native tanned leather. They were very rough in appearance; three pairs were pegged-sole Bluchers, one pair rough kip whole-back Balmorals; they would neither take more leather or time to make if they were cut a better shape and more after the English Government pattern.

QUEENSLAND only exhibited nine pairs of boots made at the Penal Establishment at Moreton Bay; these must have been for Government institutions, as no dealer would ever buy them. They could also be much improved without any extra cost, if the example of the other manufacturers in Australia was followed.

NEW ZEALAND sent two exhibits. The case from Messrs. Michaelis, Hallenstein and Farquhar, of Dunedin, contained eleven pairs of useful, serviceable boots, made from leather of their own tanning and dressing. There were good specimens of men's, women's, and boys' boots, all strong and well put together, well-finished, good useful boots; some of the exhibits would however be considered to be wanting a little in smartness, according to English taste.

Messrs. Lightband, Allan and Co. had the largest and most varied exhibit in the Exhibition; many were made only for show. Several pairs of ladies' boots and shoes were perforated all over the uppers, and coloured silk inlaid under the leather, beautifully stitched. The leather employed in the uppers was principally European; but it was a very creditable display, and the variety and novelty of styles coming from one firm deserves great commendation.

WESTERN AUSTRALIA had an exhibit of men's hand-made watertights, sent by the York Local Committee, they were strong but roughly made, with nugget nails. There was also a case of men's and women's boots and shoes; the uppers looked as if they had been made up here and soled with Australian leather in the Colony.

SADDLERY AND HARNESS.

For the following report I am indebted to Mr. John Beauchamp (Messrs. Bliss, Beauchamp and Bliss).

The quantity of saddlery and harness at the Exhibition was not large, and it may be briefly said that what was there was generally distinguished by good substantial workmanship rather than by excellence of material or by neat and well finished handiwork. The articles displaying the highest style and finish came from Victoria and South Australia. Most of the other goods were much the same class as would be made in the rural districts of this country. The prices of the goods were not given in all cases, but where they were quoted they seemed to be much about the same as would be charged by English saddlers.

CANADA.—Messrs. Fisher and Blouin, of Quebec, sent some fairly-made harness and saddlery, chiefly of the style used in the United States.

Mr. E. T. Hutchings, of Winnipeg, showed some interesting dog harness and cowboys' outfit. Mr. J. Choquette, of St. Hyacinthe, Quebec, exhibited good Express and Buggy harness. The Hamilton Whip Company of Hamilton, Ontario, had a large collection of whips, of which it may be said that many of the driving whips were very good for the prices marked on them, but the riding whips were dear. Both kinds were spoiled by the use of common mountings.

NEW SOUTH WALES.—Mr. J. J. McGrath, of Wagga Wagga, sent a stock saddle designed by himself, of strong rough material, but well made.

Mr. S. Stephens, of Narrapri, also exhibited a stock saddle of his own invention, with great knee-pads, and of rough material and workmanship.

Mr. John E. P. Walker, of Cooma and Goulburn, showed six saddles, all of which were well made, and quite equal in workmanship to most English goods of the kind; but the hogskin in them was not so nice as it might be.

VICTORIA.—Messrs. Altson & Co., of Melbourne, showed a very fine collection of saddlery and harness goods. Amongst it was a rough-riding or breaking-in saddle, of which both the materials and the workmanship were good. The same may be said of a stock or station saddle. A set of Buggy harness, with inlaid furniture, was also well made of good leather. Their pack saddles and explorers' water bottles were of a very superior quality and make. Messrs. W. Knight and Co., of Sandhurst, sent some Buggy harness of fair quality, and some well-made Colonial saddles. From the Penal Department came saddles of a quality which, as might be expected, cannot be termed first-class.

SOUTH AUSTRALIA.—Messrs. J. Colton and Co., of Adelaide, sent some of the best saddles and harness, both as regards quality of material and of workmanship, which were in the Exhibition, and their prices were not above those of good West-end saddlers.

Mr. W. Genery, of Adelaide, showed a camel saddle, which appeared to be well designed for its object.

QUEENSLAND.—Mr. R. E. Jarman, of Brisbane, sent some well-made saddles and harness; but in many of the articles the material was poor. Mr. Wm. Purcell, of Rockhampton, sent a patent saddle for breaking-in horses, made of very strong hide, flesh out. He claims for it that it allows for ventilation, and that it has other advantages. He also showed other strong roughly-made saddles. The Penal Establishment, St. Helena, Moreton Bay, sent a large number of saddles, pack saddles, bridles, harness, military accoutrements, &c., in which strength seemed aimed at rather than fine workmanship.

WESTERN AUSTRALIA.—A set of strongly-made cart harness, well sewn, such as would be made in an English country town.

NEW ZEALAND.—Mr. Wm. Wiggins, of Wellington, showed a set of Scotch cart harness of good average quality.

TANNING MATERIALS.

INDIA AND SINGAPORE.*

At present our supplies of tanning material from India are limited to myrabolanes, of which from 20,000 to 25,000 tons reach this country annually. As however Singapore is subordinate to the Presidency of Bengal, we may include gambier in our enumeration, and of this as much as 25,000 to 30,000 tons annually are received, the combined value of these two articles being fully three-quarters of a million sterling. Both were represented in the specimen cases exhibited in the Indian Court, in addition to which there were many varieties of bark, gall-nuts, &c., which possess the greatest interest for leather manufacturers here, and show how rich India is in tanning agents. The inspection of these serves to account for the development of tanning in India, and the important increase that has taken place of late years in tanned kips, goat, and sheep skins, sent to this country and the Continent, and also to the United States.

By the kindness of Dr. George Watt, C.I.E., the special officer in charge of the Economic Court, many specimens of the undernoted barks have been obtained, and he has also given many valuable and suggestive comments thereon. In some cases only an extract from the notes in the Official Catalogue is given.

1. *Acacia arabica*, or the Indian gum arabic tree, a small thorny tree common everywhere in India. The bark is a powerful astringent, and is one of the tanning substances most extensively used in India. If sent to this country, chopped or ground like mimosa, or as an extract, it would no doubt find a certain market, which would become important, if it were found a desirable addition to the tanning substances used in this country, and could be delivered here at a moderate cost. The pods of this tree, when the seeds are removed, are also rich in tannin. If ground to a powder like sumach, and packed in bags, there would be no difficulty in obtaining for it sufficient trial in this country to determine the question of its probable commercial value.

2. *Acacia catechu.*—Cutch, a tree 30 to 40 feet high, abundant in the forests of India and Burmah. Its extract, similar to gambier, is well known, but it is not so well adapted for tanning purposes as for colouring and preserving the nets, lines and sails of our fishing industry. The bark, being of pale colour and rich in tanning property, might find favour with tanners here as a rival to mimosa.

3. *Acacia leucophlæa.*—A tree met with in North, South and Western India and Burmah. The bark is of pale colour, and is valued as a tan, giving a pinky tinge to the leather produced from it, similar to that derived from the bark of another tree of this family (*A. Jacquemontii*).

4. *Arogeissus latifolia.*—This tree is found in the sub-Himalayan tract from the Ravi eastward, and in Central and Southern India. It is very plentiful in Melghát. The bark and leaves are extensively used for tanning in India, and if found suitable for the European market, could be more largely and cheaply supplied, as stated by Dr. Watt, than any other Indian tan. The leaves would have to be ground into dust like shumac, and the bark treated like Australian mimosa, to make them available for export.

* These have been admitted for the sake of comparison.

5. *Cassia auriculata.*—A common shrub in South and Central India, the bark of which is one of the most valuable of Indian tans. The same remarks apply to this as to the acacia bark above mentioned.

6. *Cæsalpinia coriaria.*—This is the American divi-divi or sumach. It has been successfully introduced into India, especially in the Madras Presidency, and as it has been found to have a salutary effect on the soil where it is grown, it will doubtless be more largely introduced. The pods are not equal in quality to the divi-divi imported from Rio Hache, but there is no reason why with intelligent treatment they should not become so.

7. *Ceriops candolleana.*—Often called a mangrove, a small evergreen tree met with on the muddy shores and tidal creeks of India and the Andaman Islands. This, and *Ceriops Roxburghii*, are of much the same character, and both are said to yield a bark which is an exceedingly valuable tan, imparting a good red colour to leather, and which ought to be brought more prominently to the notice of European tanners.

8. *Eugenia jambolana.*—A moderate-sized tree found wild or in cultivation all over India, from the Indus eastward. The bark is a powerful astringent, and might be a useful tan, but is used chiefly by druggists.

9. *Hymenodictyon excelsum.*—A large deciduous tree with smooth bark, met with on the dry hills at the base of the Western Himalayas, throughout the Deccan, Chutra Nagpur, and Central India. The inner bark is astringent, and might be adapted for tanning.

10. *Mallotus phillippinensis.*—A small tree of the sub-Himalayan tract from the Indus eastward, the bark of which is largely used in tanning in the North-West Provinces.

11. *Mangifera indica.*—The mango tree, a densely branched tree, wild on the Western Ghâts, the Chutra Nagpur Hills and the Naga Hills, cultivated all over India for its fruit. The leaves are used for tanning by the poorer classes in Oudh, and the bark is said to be used as tan in the Dacca district, Bengal.

12. *Phylanthus emblica.*—A moderate-sized tree in the dry forests of India and Burmah. The fruit is the emblic myrabolane used in dyeing and tanning. The leaves are also used in tanning in most parts of India, and are regarded as one of the best tans by the Bengal tanners. If ground to a powder, they would be more likely to be serviceable here than the nuts.

13. *Quercus lamellosa.*—A large handsome tree, with broad serrated leaves, met with in Nepaul and eastward to Sikkim, Bhutan, the Naga Hills, and the mountains on the Burmah-Manipur frontier. In Darjeeling the bark is used for tanning, and it has the appearance of being well adapted for that purpose.

14. *Rhizophora mucronata.*—The mangrove tree, a small tree, frequent in tidal forests. The bark is used for tanning, but does not make good leather.

15. *Soymida febrifuga.*—The Rohun tree, found in the hilly districts of North-West, Central, and Southern India. The bark is astringent, and a powerful febrifuge, being an excellent substitute for the Peruvian bark. It is of a desirable pale colour, and appears to contain a high amount of tanning principle. Experiments are likely to be made with this bark to test if it is as serviceable as its appearance would indicate.

16. *Tamarix.*—Tamarisk, of which there are six species in India, the gall-nuts of which are highly prized on account of the great amount of tannin they contain. They are regarded as one of the most valuable of Indian tans.

17. *Terminalia.*—Several species of trees belonging to this genus afford valuable tans. The bark of all is rich in tanning material, and the fruits of at least two constitute the so-called myrabolanes of commerce—viz., *chebula*, the black myrabolane; and *belerica*, the beleric myrabolane.

A few other interesting specimens, all more or less useful for tanning purposes, might be added to the list; but they are generally in smaller supply than the above, or not so well adapted for exportation.

The Rev. A. Campbell, Santul missionary, Chutta Nagpur, exhibits an interesting series of myrabolanes, terminalia galls, and terminalia bark. The various forest officers throughout India have also contributed largely, and with the special show case furnished by the Chamber of Commerce of Bombay, the collection of Indian myrabolanes now on view is one of the largest and most complete ever exhibited.

CANADA.

Canada uses only one tanning material—hemlock bark—for the manufacture of its leather. Certainly good leather, both sole and upper, can be made out of this rather unpromising material, as was shown in the extensive exhibits in the Canadian Court; but the bark itself, and the extract produced from it, and largely used in this country, are so well known that it is unnecessary to make an extended report upon them. Only the extract is used here, and usually in combination with other tans, for the production of a cheap description of leather.

AUSTRALIA AND NEW ZEALAND.

Australia and New Zealand may be grouped together for the purpose of this report. They have an admirable tanning agent in the bark of the acacia mimosa, or wattle, as it is spoken of in the country. The leather produced by means of this bark is some of it of bright colour and high excellence, and large quantities are sent to this country, where it sells as readily as the production of our own tan-yards. The black wattle bark is the richest in tanning properties, and the best is that shipped from Adelaide, where the chopping, grinding, packing, &c., is as well done as it is capable of being. Some excellent specimens of this bark were exhibited in the South Australian Court, and, though it may be invidious to make distinctions, great credit must be paid to Messrs. F. Pflaum and Co., Blumberg, for their admirable selections of both chopped and ground Adelaide bark. Samples were shown by H. Willis and Co., and others, which were also of high merit. Some years ago the Victorian Government imposed an export duty of £3 per ton on bark shipped from that province, with the idea probably of preventing the export of mimosa, and so keeping the price low to the Colonial tanners. This impost, however, was in force barely three months; it was found that, if continued, it would be driving a large trade from their Colony to others, where no such tax existed, and that such artificial modes of securing protection would not be conducive to good

business relations with other countries. As such well-known shipments as the I. K. Pow and Stawell Wehl marks come from this district, there was some apprehension here when the intention to impose a duty was announced, and a corresponding relief when the ill-advised measure came to nothing.

The manufacture of extract from both the wood and bark of the mimosa was mentioned by one of the representatives of the Australian Courts as having been commenced, and if successfully carried out, it might be the means of economising freight on such a long sea voyage. Otherwise tanners in this country are very well satisfied with the bark, whether chopped or ground, sent by the best-known shippers, and the skilful combination of this most valuable tanning agent with English oak-bark, myrabolanes, and valonea, has enabled experienced tanners to produce sole leather little inferior to that made from pure oak-bark, in half the time, and at a material reduction of the cost of tanning compared with that of the old system.

The Tenekaha bark (*Phyllocladus trichomanoides*, a tree of the yew family), that comes from New Zealand, is used by dressers of glove leather to give the fashionable tan tint to Cape and other gloves. A specimen was exhibited in our 1851 Exhibition, which attracted the notice of a leading house in that line in London. For many years they enjoyed a profitable monopoly of their useful discovery, but the secret has been an open one for the last twenty years, and all the principal glove-leather dressers now know and use the bark that produces this popular colour.

Cape Colony and the South African States sent us plenty of hides and skins, but no leather or bark, and yet the Cape mimosa (*Acacia Molipima*) is believed to be almost as valuable for tanning purposes as that of Australia. It could, no doubt, be cultivated to any extent, and at no distant date we may have shipments of leather and bark from the Cape as from our other Colonies.

FURS AND SKINS.

For the material for the following report on the fur-skin exhibits, I am indebted to Mr. Ince, the agent of the Hudson's Bay Company. This was probably the most interesting of the skin exhibits to the general public. The Hudson's Bay Company and Messrs. Renfrew had each a splendid show of specimen skins.

The Hudson's Bay Company was specially invited by the Canadian authorities to exhibit specimens of the valuable fur products from its hunting grounds, and the Canadian section was enriched by an interesting collection of the choicest furs, including skins of the :—

Badger,
Bear, black,
,, white,
,, grizzly,
,, brown,
Beaver,
Fisher,
Fox, white,
,, blue,
Fox, red,
,, cross,
,, silver (variety),
,, kitt,
Lynx,
Marten,
Mink,
Musk Ox,
Musk Rat,
Otter,
Sea Otter,
Rabbit,
Hare,
Racoon,
Skunk,
Wolf,
Wolverine.

Each of the above specimens was the finest of its kind, having been selected from the most recent importations.

It is not generally known that Russia derives half its supply of ordinary furs, and the whole of its important ones from British Possessions, and the United States.

The entire importation of fur-skins by the Hudson's Bay Company, and the greater portion of those from the United States, as given in the tables below, are sold by public auction in London, thus exempting the London merchant from any cost of commission, tariff, or transit. This market is attended by Continental and American buyers.

These advantages are greatly in favour of the home trade, in addition to our excellence in dressing skins and their manufacture by the number of skilled artificers who are attracted to the metropolis by such lucrative employment.

Uses of Skins.

Sable.—Most manufactured in natural colour now, gaining in popularity from year to year. Capes, muffs, boas, coat-linings, &c.

Fisher.—Light-pelted skins taken by St. Petersburgh, heavy-pelted by Moscow and Poland, exclusively used for fine fur coats and collars. National (Polish) cap prohibited by Russian Government, yet still worn by orthodox Jews. Tails vary in colour, average value 5*s.* 6*d.*

Mink.—For a long time unable to gain a footing, this article has lately become fashionable; it is a very durable and handsome fur, still largely taken by Mid-Europe, where it is always fashionable and popular. Used for capes, muffs, coat-linings, dolmanettes, trimmings, &c.

Skunk.—Best sorts imported from the United States of America, Michigan, and Ohio, producing the finest class. The less striped the finer the skin. Always largely used in France and Germany, it has of late years become popular in England, it being one of the few natural furs of a black colour. Capes, muffs, boas, trimmings, &c.

Musquash.—Recently coming to the fore as a cheap natural fur, but still mostly consumed on the Continent, where it is used for a variety of purposes, as fur coats, muffs, pelerines, &c. Now extensively used, pulled and dyed brown, for imitation seal, both here and on the Continent.

Beaver.—Until recently, mostly consumed by Russia, France and Germany, where it is used for fur collars, and for coat-linings: of late very fashionable in America, and this year *the* fashionable fur in England. The beaver hat being all but extinct, but very few, and these the common sorts, are used for cutting purposes. Value nearly doubled the last ten years. It is dyed in a variety of ways, black, brown, with hair and pulled, and silver points are marked in the skin to imitate sea otter.

Otter.—Bought for Russian market almost entirely, and large quantities of European also are sold at Nichni Fair annually, where it is an article of trade with the Chinese Tartars, &c. For several years it has also been used in America and England in the pulled or unhaired state. The fur is close, somewhat resembling beaver, used for boas, capes, muffs, coat-linings, &c.

Sea otter.—Average annual importation 3000 to 4000, principally from Alaska, a few being caught off the Japanese coasts. The Hudson's Bay Company secures very few ordinary skins in the North-West Territory.

Almost exclusively taken by Russia, where it is held in high esteem by the richer portion of the population, to whom it is almost a national fur. Used principally for collars and capes, and for ladies' collars, muffs, and trimmings. Prices for a gentleman's collar range from R° 70 to R° 1500. A very choice and dear fur, one skin having brought as much as £105. When it was cheaper, France consumed a good many. Two hundred Japanese sea otters are annually imported in addition to those quoted from the West Pacific.

Fox.—Silver and black are the most valuable; £60 has been paid for a choice specimen. Cross are less valuable, but both sorts are sought after by the Russians principally, some few being taken by France and England. Every part of the silver or cross fox serves for a different article: thus, necks, paws, locks, and backs are made up separately into a variety of things. Red are used by the Russians, Greeks, Turks, and Galicians. Russia uses the locks; Greece, the backs; and at the Fairs, the merchants of each country sell that portion of the skin they have no use for. The white are not much used in their natural state, only a few being pure white. It is largely used in England, France, Germany, and America, dyed black (lately, even blue, to imitate blue, and silver fox) as trimmings, boas, &c.

Bear.—The skin of the black bear from British North America is much used in this country for military purposes, capes, boas, trimmings, and rugs, and the skin of the cub bear is highly valued in Russia for coat-linings and collars. The skins of the grey and brown bears are applied to similar purposes.

Wolverine has recently advanced much in value, the dark centre or saddle being used for dress purposes to imitate sable tails.

Racoon varies much in quality, the finer and paler sorts showing a brilliant lustre when dyed, which, of late years, has caused them to be in great request.

Lynx has also nearly doubled its value this year, owing to the great demand in United States America for bright jet-black fur; these skins being specially adapted for dyeing purposes.

As evidence of the great fluctuations in our imports caused by variations of fashion, fitch, kolinski, ermine, baum and stone marten have almost ceased to be shipped to this country, while the present year's import of squirrel is only 500,000. On the other hand, of German and Continental otters, some 20,000, or two-thirds of the entire European supply, have been imported this year.

From our Australian Colonies, we import some 2,000,000 opossum skins, which has become a favourite fur on the Continent, as well as in this country, a large proportion being dyed dark brown and black, and the natural colours used in Russia and elsewhere for coat-linings, capes, muffs, carriage wrappers, &c. About 50,000 to 60,000 Wallaby are also imported, the best quality used for fine upper leather in boots, and the commoner sorts are sold by hawkers to imitate chamois leather; 50,000 Wombat come to England, the fur is very close, strong, and durable, and many are dyed dark brown and black to be used for rugs and dress purposes; 500,000 Kangaroo skins are shipped annually from Australia, but these skins are mostly taken by America.

The following table shows the total importation for 1886 of fur seal skins:—

Alaska	124,048
Copper Island	41,750
Robbin Island	1,832
Victoria and Vancouver	10,000
Cape	4,000
Japanese	19,000
Lobos Island	12,000
Total	212,630

Subjoined are tables showing the imports and exports of skins adapted for furs in 1851, 1863, and 1886. The first table was given in the Report of the Jury for this class in the Exhibition of 1851:—

Denomination of Skins.	Total importations into England.	Exported.	Consumed in England.
Racoon	525,000	525,000	none
Beaver	60,000	12,000	48,000
Chinchilla	85,000	30,000	55,000
Bear	9,500	8,000	1,500
Fisher	11,000	11,000	none
Fox, red	50,000	50,000	none
,, cross	4,500	4,500	none
,, silver	1,000	1,000	none
,, white	1,500	500	1,000
,, grey	20,000	18,000	2,000
Lynx	55,000	50,000	5,000
Marten	120,000	15,000	105,000
Mink	245,000	75,000	170,000
Musquash	1,000,000	150,000	850,000
Otter	17,500	17,500	none
Fur Seal	15,000	12,500	2,500
Wolf	15,000	15,000	none
Marten, Stone and Baum	120,000	5,000	115,000
Squirrel	3,000,000	100,000	2,900,000
Fitch	65,091	28,276	36,815
Kolinski	53,410	200	53,210
Ermine	187,104	none	187,104
Rabbit	120,000	none	120,000
Wolverine	1,200	1,200	none
Skunk	1,200	1,200	none
Sea Otter	100	100	none

LONDON IMPORTS OF NORTH AMERICAN FURS IN 1863 AND 1886.

Denomination of Skins.	Hudson's Bay Co.		United States.		Total.	
	1863.	1886.	1863.	1886.	1863.	1886.
Bear	7,231	8,177	3,368	10,596	10,599	18,773
Beaver	113,915	102,614	21,880	14,547	135,795	117,161
Fisher	6,064	4,022	2,741	3,302	8,805	7,324
Fox, cross	1,912	3,173	1,072	3,780	2,984	6,953
,, grey	—	—	13,496	6,511	13,496	6,511
,, kitt	5,452	—	4,680	—	10,132	—
,, red	6,461	11,356	37,518	53,965	43,979	65,321
,, silver	590	855	314	1,050	904	1,905
,, white	3,451	3,320	35	2,874	3,486	6,194
Fur Seal	—	—	—	212,630	—	212,630
Lynx	4,609	51,387	3,137	8,058	7,746	59,445
Lynx Cat		—	5,272	3,575	5,272	3,575
Mink	43,767	76,374	26,998	321,170	70,765	397,544
Musquash	356,904	347,046	1,726,202	2,045,971	2,083,106	2,393,017
Opossum	—	—	57,489	223,964	57,489	223,964
Otter	13,162	10,841	6,481	9,150	19,643	19,991
Racoon	3,812	—	462,156	477,283	465,968	477,283
Sable	78,786	78,856	20,388	50,681	99,174	129,537
Sea Otter	128	10	219	4,260	347	4,270
Skunk	1,969	21,189	86,348	467,196	88,317	488,385
Wolf	3,915	1,204	1,111	1,852	5,026	3,056
Wolverine	1,414	1,198	—	433	1,414	1,631
Hair Seal	17,343	—	—	10,199	17,343	10,199
Rabbit	—	45,118	—	—	—	45,118
Badger	—	1,471	—	4,931	—	6,402
Fox, blue	—	—	—	4,000	—	4,000

TIMBER.

No. I.

By THOMAS LASLETT, Timber Inspector and Surveyor of Forests to the Admiralty (Retired), Late Lecturer on Timber at the Royal School of Naval Architecture, South Kensington, and at the Royal School of Military Engineering, Brompton.

CANADA.

THE Timber Exhibits of this Court included ten from Anticosti and 108 from the Geological and Natural History Department, as per Catalogue. Mr. Black, Nova Scotia, sent a collection of woods; Mr. Marshall, pine deals; The Canadian Government, Ottawa, British Columbia woods; The Canadian Pacific Railway Company, woods of North-West Canada; The Hastings Saw Mills Company, Burrard Inlet, British Columbia woods; Messrs. Howe, McLaren and Company, New Brunswick Government, and other contributors, woods, collections of woods, and samples of wood.

The timber exhibits collectively made a remarkably good display, and the samples of certain woods shown in the log served well to illustrate the character of the descriptions it is desired to bring into prominent notice; while the samples in smaller dimensions of other woods sufficed for their purpose. The Catalogue gives no information as to the habits or size the trees generally attain, or whether any are abundant; but by reference to a small pamphlet on the Canadian Forests, liberally distributed in the Court, I have been able to learn much that is of interest about them; and by this, and a careful inspection of the exhibits, to frame the report. I have given a descriptive account of the chief and most important, some twenty-two in number; I consider there is an abundant supply of timber suitable for constructive purposes, a fair amount for furniture, while the remainder would be fit for local purposes. I proceed to notice some of the most important trees of the Colony.

Acer, common name Maple. This tree has a wide range in the Dominion, and according to the Catalogue there are nine species of it. It attains moderate dimensions, yields a whitish, close-grained wood, commonly plain, although in many instances it is found mottled in appearance, or, as the cabinet-makers say, has a bird's-eye figure. In commerce this is known as the Bird's Eye Maple; and when this is the case, it is eagerly sought for, and commands a high or fancy price in the market, while the plainer descriptions are also in request, as they are useful for many less ornamental purposes, carpentry, turners' work, &c. In British Columbia the Maples attain larger dimensions, but they do not appreciably differ in colour, hardness, specific gravity, or usefulness from the before-mentioned.

Betula, Birch. There are at least four kinds of Birch in Canada, these being of wide-spread growth, flourishing in exposed situations, and on a poor soil: they attain medium dimensions, and yield a whitish wood, clean and smooth in grain, moderately hard, and easy to work. The wood has been used with advantage in ship-building, and is suitable for plain cabinet-work.

Carya, Hickory. These trees are moderate in size: the wood is of a pale straw colour, straight and clean in grain, moderately hard, tough, elastic, and strong. It is suitable for agricultural implements, carriage-building, tool-handles, handspikes, and many purposes in the domestic arts.

Fagus ferruginea, Ait., Beech. The beech trees are very common in the Dominion, flourishing best on good soil, where they attain large dimensions. The wood is straw colour, close-grained, hard, heavy, and suitable for a greater variety of purposes in the domestic arts than almost any other. If submerged in water it is next to imperishable, and it can be used with advantage for engineering and ship-building purposes. If exposed, however, to atmospheric changes, it soon becomes "doated" with white spots, and rapidly decays. Tested by its medullary rays or silver grain, which is conspicuous, it cleaves well, and makes good wedges.

Fraxinus, Ash. There are three kinds of Ash trees in Canada: each attain moderate dimensions, and yield timber of a light brown colour, moderately hard, tough, strong, elastic, and not heavy. The wood is useful for wheelwrights, coopers, and turners; further, it makes good tool handles and boat oars. There stood among the exhibits in the open a log of Waney White, and a log of Black Ash (*F. sambucifolia*, Lam.); this was very solid and better in quality than the White.

Juglans nigra, Linn., Walnut. This tree attains a large size, the trunk being frequently met with four feet in diameter. Its wood is light, and of a brownish hue, with darker shades towards the centre, close-grained, easily worked, and as it takes a fair polish, it is in request for furniture, joiners' work, turnery, gun-stocks, and many other useful purposes. The Butternut, *Juglans cinerea*, Linn., smaller than the Walnut, is employed for similar purposes. A good sample of Waney Black Walnut in the log stood in the open at the south-east corner of the Exhibition.

Larix americana, Michx., Larch. A deciduous tree, of the Pine family; prefers dry rising ground, and grows with a straight stem. Its wood is pale grey, or straw colour, close-grained, hard and strong. It is suitable for carpentry and ship-building, and has the reputation of being durable. It should be thoroughly seasoned before being used for any purpose, otherwise it warps considerably. In British Columbia the Larch attains larger dimensions than in Canada proper; it yields a strong coarse-grained timber, suitable for engineering purposes.

Picea, Spruce. These trees are of small dimensions, and grow freely in the Dominion; the wood is whitish in colour, coarse in grain, moderately hard, knotty, not easy to work. An immense quantity of deals are produced from these trees, suitable for the rougher kinds of carpentry. Small spars for boats and vessels are frequently made of Spruce; and it is also in request for scaffold poles for builders' use.

Pinus Strobus, Linn., White, or Yellow Pine of commerce. These trees at full growth are very large, often attaining 120 feet in height, and four feet in diameter. In the depths of the forest they have few branches, and present a clean stem free from knots a long way up; these being suitable for most purposes, are treated with care in preparation for the market. The wood is whitish in colour, with smooth grain, soft, of light weight, and fit for joiners' work, insides of houses, and for any employment not depending upon strength of material. It should be seasoned well before use, then

painted, and it will last a long time. A good sample of White Pine timber in the log stood in the open, near the south-east corner of the Exhibition.

Pinus resinosa, Ait., Red Pine. These trees are much smaller than the White Pine, and grow straight, or nearly so, yielding timber of a light colour, close in grain, moderately hard, strong and durable. The wood makes good masts and spars, and planking for ship-building. It is suitable for all kinds of carpentry, and for general purposes. A good sample of Red Pine timber in the log stood in the open near the south-east corner of the Exhibition.

Pseudotsuga Douglasii, Carr., Douglas or Oregon Pine, British Columbia. Is by far the largest of the Pine species, and the most important tree of the district; it grows to a great height, there being few, if any, exceeding it in any part of the world; 200 to 300 feet in height is said to be common, with 6 to 8 feet diameter. The wood is of a reddish-yellow colour, straight in grain, a little wanting in cohesion of the annual layers, and therefore does not well bear friction, while it is moderately hard for pine, and is easily worked. As an article of commerce, there is a considerable demand for it for masts and spars, for yachts, and shipping, as it can be obtained 80 to 100 feet clear of knots. Out in the open, near the south-east corner of the Exhibition, a cross section stood, measuring 5 feet 3 inches square, while another with the bark on measured 7 feet in diameter, and had only about 2 inches of alburnum or sapwood; each of these had the heart shake open for some distance from the pith, but this defect is not uncommon to trees of large dimensions. Further, there were several squared logs of timber, also in the open, adjoining the Court, perfectly clear of knots, or any defects.

Quercus, Oak. There are eight species of Oak in the Dominion, and these appear to be of wide-spread growth. Nearly all are tall trees, and stout withal; the wood is light to dark brown in colour, close and straight in grain, hard, of moderate strength and weight, works up well and easily, and is suitable for church fitments, furniture, engineering, architectural and ship-building purposes, staves for casks, &c. The economic uses of this timber are very great, and the demand for it in the English markets is likely to be considerable. The White, Red and Black varieties are said to be the best in quality, but the Swamp-White, Scarlet, Mossy Cup, Pin, and Chestnut Oaks are perhaps only a little inferior, and one might easily be substituted for the other. Samples of these oaks stood in the open, near the south-east corner of the Exhibition, fairly illustrating the quality of the Canadian oaks.

Ulmus, Elm. Three species of this tree are mentioned; they all appear to attain large dimensions, and yield timber of a brown colour, close and curly in grain, hard, tough, and suitable for keels of ships, for wheelwrights, and carpentry purposes. Rock Elm, *U. racemosa*, Thom., is a slow-growing tree of moderate dimensions; the wood is straw colour, has a fine close grain, is hard, heavy, strong, flexible, and suitable for planking in ship- and boat-building, agricultural implements, and carriage works.

Although the forests in Canada have for a long period been drawn upon for the supply of White and Red pine, spruce, oak, &c., for the English markets, it is believed that even now, as above stated, there is an abundance of all these remaining to meet local requirements, and, to a considerable extent, foreign orders likewise.

NEW SOUTH WALES.

The Timber Exhibits of this Court were, by the Commissioners for New South Wales, 13; by the Minister for Mines prepared by Forestry Officers, B to M, 239; also by the Minister for Mines, M to V, 112; G. U. Alley, Sassafras, 6; T. Davis, Terrigal, 59, and R. G. Higgins, Sydney, 41; making a total of 470 in number.

The timber exhibits marked B to M may be said to cover, with a few exceptions, the whole range, since the same woods appear in Catalogue, Nos. 284 to 289 inclusive. It is therefore the parcel B to M that I purpose chiefly to treat, these being in planks of considerable dimensions, and shown in trophy form in the centre of the Court, where they admirably illustrated the character of the timber of the trees, and gave a good idea of their value for constructive and other purposes.

A careful study of these during the inspection gave an impression that the Colony abounds in hard, heavy, strong woods suitable for engineering and architectural works; that a fair quantity would make good furniture, while the remainder could well be adapted for local and general purposes.

The Catalogue is not alphabetically arranged, but the information it contains is ample for guidance, and following is a descriptive account of some seventy-eight in number, of the most important and best in quality.

Acacia. There are nineteen species of this genus in the Colony, which afford timber, including seven of the Wattle, five Myall, three Hickory, and one Mother-humba, this being the largest of the class. Except the Silver and Black Wattles, which are small scrub trees, the others attain moderate dimensions, yielding hard wood, moderately heavy and strong.

The Myall trees are generally of small growth, *A. pendula*, A. Cunn., excepted, which attains moderate dimensions. The wood is violet-scented, dark coloured, hard, heavy, close-grained, and often beautifully marked; it is in request for tobacco pipes, and fortunately is plentiful.

Hickory, or Spearwood trees of this class are of moderate dimensions, strong, tough, and close-grained; thus the timber of the *Acacia* class before mentioned would be useful by careful selection for furniture or for agricultural purposes. The remaining three varieties are of little value, except for very ordinary purposes.

Alphitonia excelsa, Reiss., the Red Ash or Leather Jacket tree, is of considerable dimensions; the wood is hard, close-grained, and takes a good polish. It is useful for gun-stocks, turnery and wheelwrights' purposes.

Araucaria Cunninghamii, Ait., Moreton Bay Pine, assumes large dimensions, and grows to the greatest perfection on dry rising ground; the wood is white, light and easy to work; being of fair quality it can be used in carpentry and for cabinet purposes.

Backhousia myrtifolia, Hook. & Harv., the Myrtle tree. Is in two varieties, each attaining moderate dimensions; the wood is close-grained, hard, heavy, and likely to be durable; from its appearance it would make good tool-handles, and be fit for turnery, wood engraving, &c. It is moderately plentiful.

Casuarina, the Forest, Swamp, He, She, and Bull Oak trees, all attain moderate dimensions, have hard, strong, tough timber, chiefly of use for agricultural purposes; the wood cleaves well for shingles.

Dysoxylon Muelleri, Benth., the Rose-wood tree, of which there are three varieties, attaining in each case to considerable dimensions; they are the largest indigenous timber trees of the Colony. The wood is reddish in colour, close-grained, of moderate weight, strong, and in working yields an agreeable perfume. It is valuable for carpentry, furniture, turnery and general purposes.

Echinocarpus australis, Benth., Maiden's Blush. A tree of large dimensions, yielding a rose-coloured wood, close-grained, easily wrought, that is fit for cabinet-making, ornamental and general purposes.

Elæocarpus obovatus, G. Don, and *E. cyaneus*, Ait. There are two species of this genus, one commonly known as the Pigeon-berry Ash, is a light, tough timber of good quality, fit for employment for boat oars;—the other, the Blue Fig, yields a white, tough, close-grained timber, with a large amount of alburnum or sap,—this part of it would be waste in manufacture, but otherwise it is fit for wheelwrights and for building purposes.

Emmenospermum alphitonioides, F. Muell., Dogwood or Mountain Ash. Is a tree of large dimensions, yielding excellent timber for boat-building, oars, coopers' and wheelwrights' work, tool-handles; is useful for building purposes.

Endiandra, the Redwood and Corkwood trees, are both found of large dimensions; the former has a fine grain, red in colour, prettily marked, is fit for use in cabinet work; the other is of lighter weight, softer, easy to work, also fit for cabinet work and for employment in carpentry.

Eucalyptus. Of this genus there are thirty-seven species which supply timber, viz. seven of the Gum, five Ironbark, three Stringy-bark, two Mountain Ash, two Woollybutt, six Box, a Tallow-wood, a Blood-wood, a Swamp Mahogany, and nine others of less note. As to the seven known as the Blue, White, Red, Grey, Spotted, Flooded, and Mountain Gum, all are tall trees of straight growth, having diameters ranging from 3 to 5 feet; the colour of the timber is generally light brown, hard, heavy, strong and durable, while the Flooded variety has the further property of being impervious to white ants and the teredo. The Blue Gum is liable to warp in seasoning, which detracts somewhat from its value—but otherwise all these woods are available for use in the construction of bridges and in engineering works, also for ship-building and wheelwrights' purposes.

The five varieties of the Ironbark are known under the common names of Black, White, Grey, Fat-cake, and Silver-leaf; these, like the Gums just referred to, generally attain a straight and lofty growth, with a slightly less stoutness of stem. The Silver-leaf variety however, is of more moderate dimensions, and it is remarkable that this tree is liable to premature decay at the centre, or pithy part; consequently it is of less account for manufacture. The timber of the others is good, dark red in colour, hard, heavy, strong, durable, fit for civil, and naval architecture, and for agricultural purposes. Of Stringy-bark, known also as Peppermint or Messmate, three varieties are mentioned in the Catalogue, which appear to differ but little from each other. They attain moderate dimensions, the wood being hard, heavy and strong. Except for the defect of gum shakes, to which it is liable, detracting something from its value, this timber can be employed for furniture.

Mountain Ash. Of this there are two varieties, and these appear to

be of straight growth and large dimensions; the wood is moderately hard and heavy, strong, flexible, cleaves freely, and is valuable for shafts of carriages, poles, staves, shingles, and some kinds of carpentry.

Woollybutt and Blackbutt, or Flintwood. These trees are of large dimensions, especially the latter, which frequently attains the height of 150 to 200 feet, and diameter of 6 to 12 feet, occasionally to 15 feet. The timber of these trees is hard, heavy, and considered as strong as Ironbark. It is used for shipbuilding, bridges, and rough carpentry.

There are several kinds of Box trees; the Blue, Black, Grey, Yellow, and Two Bastard, the dimensions of the four preceding being more moderate than the *Eucalyptus* trees before referred to. The timber is hard, heavy, dense, and close in grain, fairly good for wood-engraving, carpentry and wheelwrights' purposes. As to the Bastard Box trees—one being known as Lignum Vitæ—they yield stout scantlings for ship-building and civil architectural purposes. The Tallow-wood tree, so called on account of its yielding timber of a greasy nature, attains large dimensions; the wood is moderately hard, strong, and considered durable; not being liable to shrink much in seasoning, it can be used with advantage in ship, boat, and house building, and for general purposes. Mr. Davis had a flitch of this wood in the Court 6 inches by 34 inches by 16 feet, good in quality, that admirably represented the Tallow-wood tree.

Blood-wood. This, again, is a tall tree of large dimensions, the sample specimen indicating it to be of good quality, sound, of a dark brown colour, moderately hard, and fit for engineering purposes. It is said, however, to be liable to gum veins, like the Stringy-bark, and hence this defect would disqualify it for use for furniture, or anything of an ornamental character.

Swamp Mahogany. This tree attains noble dimensions, flourishing on low moist ground in open forests; the wood is hard, heavy, moderately strong, but liable to gum shakes. It is scarcely fit for ornamental work; for shipbuilding, however, carpentry, and general purposes, it is of considerable value. The whole of the *Eucalyptus* class of woods are very suitable for railway sleepers. Even the trees not specially mentioned in detail are available for this service, or they could be employed for some local purposes.

Eugenia. Of this genus there are three species, commonly known as the Bush Cherry Myrtle, Cherry, and Water Gum trees; the two former are of moderate, and the latter of large dimensions; the wood is hard, tough and elastic. It is used by the Aborigines for boomerangs, &c., and is suitable for boat oars, staves, &c. The Water Gum variety, having a good red colour, is suitable for furniture.

Frenela is found in four species, viz., the Port Macquarie, Cypress, White, and Black or Red Pine; these are trees of moderate dimensions. As to the two former the timber is light, soft, easily wrought, fit for rough carpentry, and general purposes. The White Pine is rather of a scrub character, coarse and knotty, and consequently fit only for the roughest purposes; the Black is better, the timber being mottled of various shades, it is soft, easily worked, and as it takes a good polish, should be employed for cabinet work and carpentry. It is said to be impervious to white ants.

Flindersia. The Ash tree or Stavewood, Bogum-Bogum, and Long Jack; thus there are three varieties, all of moderate dimensions; their

timber is of a yellowish colour, hard, close, plain in grain, and generally sound; they are all suitable for cabinet-making, staves, poles, and general purposes.

Gmelina Leichardtii, F. Muell. The White Beech is a tree of large dimensions, the timber white, close grained, strong and durable; it is said not to shrink or warp much in seasoning, hence it would be useful for wood-engraving, carving, shipbuilding and general purposes.

Grevillea is represented by two varieties, viz. the Beefwood and Silky Oak trees; the former is of moderate dimensions, the timber hard, close-grained, prettily marked, takes a good polish, and is fit for furniture, ornamental fancy work and general purposes. The Silky Oak is of a yellow colour, moderately strong, is mottled with the silver grain as in English Beech, cleaves easily; would be useful for staves, turnery, &c.

Harpullia pendula, Planch., Tulip-wood. A tree of moderate dimensions; the timber is open grained, has light and dark shades of colour, hard, heavy, takes a good polish, and is fit for cabinet-work, turnery, and many purposes in the domestic arts. The exhibit was exceedingly sappy.

Melaleuca. There are three of this genus, viz. White, Black, and Swamp Tea tree; they are all of moderate dimensions, the timber is exceedingly hard, heavy, close-grained, strong, and said to be durable if employed in damp situations for posts or piles.

Melia composita, Willd., White Cedar. A tree of large dimensions; the timber yellow-coloured, moderately hard, with large grain; would be useful for indoor fitments, shingles, and rough carpentry.

Olea paniculata, R. Br., Marble Wood. A tree of moderate dimensions; the timber is hard, close-grained, heavy, and nicely mottled. It is used for cabinet-work, wood-engraving, turnery, and many purposes in the domestic arts.

Olearia argyrophylla, F. Muell., the Musk tree. Is rather dwarf in height, with a moderate-sized stem, the timber hard, often gnarled, mottled and figured like Bird's Eye Maple. It is consequently valuable for veneers and fancy work in cabinet making.

Orites excelsa, R. Br., commonly called Red Ash. Attains moderate dimensions; the timber is dark in colour, nicely marked, moderately hard, but not difficult to work; it takes a good polish, and is suitable for cabinet or coopers' work.

Syncarpia laurifolia, Ten., and *S. leptophylla*, F. Muell., Turpentine tree. Two kinds, each attaining moderate dimensions; the timber is hard, heavy, strong, and said to be durable if employed in damp situations, for posts, piles, or sleepers; it is used in ship-building and for general building purposes. It has the merit of being proof against the attack of the *Teredo navalis*, and of being difficult to burn.

Tristania. There are four kinds, two commonly known as Beech or Swamp Mahogany; one White Box, the other Water Gum, each being of moderate dimensions; the timber is strong, tough, close-grained, and durable. It is chiefly employed for agricultural purposes, posts, cogs of wheels, mallets, and tool-handles, and appears to be admirably suited for such purposes.

Vitex Lignum-Vitæ, A. Cunn. Is a tree of moderate dimensions, the timber being hard, close-grained, and heavy, it scarcely shrinks in season-

ing; with these properties it should be useful for a variety of purposes, especially for turnery.

Mr. Davis's timber exhibits (Catalogue Nos. 284 and 286) are very good. Mr. Higgins's (No. 287) were chiefly from small trees, and not good samples of New South Wales timber. No. 292, Minister for Mines, are very good, and likely to be appreciated by engravers.

New South Wales has clearly a large quantity of hard, useful timber for constructive and other purposes; and possibly could spare to a moderate extent some of the many varieties it holds, if a market could be found for them; on the other hand, it has few woods of light weight that are easy to work, as Fir or Pine, and for these the Colony is probably dependent upon foreign supplies.

VICTORIA.

The Timber Exhibits of this Court were by the Bairnsdale Shire Council (H. Bredt, Secretary), samples of timber from Gippsland Forest trees; by Mr. H. Costin, Ballarat, samples of timber; Department of Railways, Three Sleepers, Red Gum, Ironbark, and Box; Mr. William Johnston, Tongio, samples of indigenous timber; Baron von Mueller, Melbourne, samples of 166 specimens of Australian woods in book form; Technological Museum (J. C. Newbery, Superintendent), eighty-six exhibits prepared by F. W. Barnard; the Apollo Bay Timber Company, assortments of Victorian timber; United Shire of Metcalfe (W. C. Reeves, Secretary), sample of native woods; Wightman and Son, Steam Saw Mills, Blackwood, specimens of Blue Gum, &c.

The exhibits were numerous and interesting from the variety coming under notice, and especially so from the care taken in the production of the specimens, with illustrations of the fruit, leaf, and flower on each, by the department of the Technological Museum. These were set out in attractive form in the centre of the Court, where each piece could be seen to great advantage.

The timber exhibits of other contributors were good, even the sleepers of old wood, the Red Gum, Ironbark, and Box, being sound, and little damaged by the fastenings with which the rails had been secured to them. This speaks well for the durability of the timber mentioned. Baron von Mueller's specimens in book form were very neat and somewhat deceptive, for many persons passed by them, without discovering what they really were; others, looking more carefully to things, seemed struck with the design, and thought it a happy idea to have specimens of woods in this convenient shape. The alphabetical arrangement of the timber in the Catalogue, and the descriptive account given of the properties each species commonly possess, was all that could be desired for guidance, and coupling this with the acquaintance made of the timber on the survey, I am enabled to say that the Colony possesses a considerable number of hard woods, suitable for engineering and architectural works, a good number of furniture woods, and many that are suited for ordinary purposes

in the locality in which they are found. I purpose treating individually on some thirty-eight in number, that appear best in quality for works of construction and furniture purposes, observing that the report will by inference cover all the exhibits referred to in the opening paragraph.

Acacia. There are twelve timber-yielding species of this genus in the Colony, of which the Black, Silver, and Golden Wattles are of moderate dimensions, hardness, and weight. One, the Myall, with a dark-coloured, violet-scented wood, hard, moderately heavy, is suitable for the manufacture of tobacco pipes. One of Hickory, with usually a small stem, the wood being drab-coloured, close-grained, and a tree commonly known as Black or Light wood, of moderate size, which appears to flourish best on low, damp lands in the vicinity of rivers. The wood is of a chestnut colour, nicely marked, of moderate weight, and takes an excellent polish, all these being suitable for cabinet-work, civil architecture, gun-stocks, turnery, and wheelwrights' purposes. The other six mentioned in the Catalogue are of less commercial value, but would be useful for ordinary local purposes.

Atherosperma moschatum, Lab., the Sassafras tree. Attains moderate dimensions, and thrives best in damp, sheltered situations; the wood is dark in colour, of good quality, takes polish well, is fit for civil architecture, cabinet-making, engraving, and generally in the domestic arts.

Banksia marginata, Cav., the Honeysuckle-tree. There are three varieties of this, each flourishing well on poor soil, and in exposed situations; they never attain more than moderate dimensions, but yield a useful timber for boat-stems, knees, &c. The wood being close-grained, dark, mottled, and moderately hard, it is employed for furniture and general purposes.

Callitris, the Mountain Cypress and Desert Sandarac Pines, are trees of moderate growth, the timber light in weight, dark in colour, and easily wrought, is suitable for cabinet purposes and joinery.

Eucalyptus. There are twenty-four of this genus in the Catalogue of exhibits, varying in size from a small shrub to the exceptional and rare height of 420 feet in *E. amygdalina*, Lab., which is probably the tallest of any tree on the globe, and possibly has no rival, except the *Sequoia gigantea*, Decne., of California, and the *Pseudotsuga Douglasii*, Carr., of British Columbia. The *E. amygdalina* of Victoria is commonly known as the Giant Gum tree; in New South Wales it is known as Messmate or Stringy Bark; other noble trees, as the Blue, White, Red, Swamp, Water-rooted and Manna-drooping Gums, two kinds of Ironbark, three of Stringy Bark, besides Red, White, Grey, Yellow, and Bastard Box, one Peppermint, one Apple-scented, one Bloodwood, one Woollybutt, and two or three others. Taken collectively, the Gums, Iron, and Stringy Bark trees, are moderate to heavy in weight, varying from red to light and dark shades of brown colour, hard, and generally difficult to work.

The Blue Gum is liable to shrink, and twist or warp considerably in seasoning, this species and the Stringy Bark being peculiarly apt to blister in the annual layers of duramen, which get partially filled with gum, these defects detracting from their otherwise good properties, and restricting their uses to stout or moderate-sized scantlings. The Peppermint and Apple-scented species are trees of only medium size; of the former the specimen exhibited indicated a disposition to split, but was otherwise good

in quality; the latter is a good sound wood. The Bloodwood and Woolly-butt attain large dimensions, have hard, dark-coloured, strong timber, the former being liable to gum shakes.

The Box varieties never attain other than small to moderate size, the timber being hard, heavy, and close in grain. All the above-mentioned woods of the *Eucalyptus* class are suitable for engineering, architectural, and wheelwrights' work, ship-building, and by selection for cabinet-making, wood-engraving, and general purposes.

Eugenia Smithii, Poir., the Myrtle tree, is of moderate dimensions, yielding timber of good quality; would be fit for furniture and general purposes.

Exocarpus cupressiformis, Lab., native Cherry, is a tree of medium size, the wood is soft, has a fine grain, is suitable for cabinet-makers, turners, wood-engraving, and carving.

Fagus Cunninghamii, Hook., the Evergreen Beech, is a splendid tree, attaining considerable dimensions, plentiful on the Baw Baw high ranges; the timber is of a brownish colour, of moderate weight and hardness, has frequently some figure in the grain, polishes well, and is useful to the cabinet-maker, mill-wright, turner, and for a variety of purposes in the domestic arts.

Melaleuca. There are three species of this, commonly known as the Swamp Tea tree; they are small, the wood moderately hard, heavy, close in grain, suitable for furniture, turnery, carving, and general purposes.

Myoporum sp. A small tree, plentiful on moist tracts of country; the wood is pale straw colour, hard, of moderate weight; it would be useful for turnery, and generally in the domestic arts.

Olearia argyrophylla, F. Muell., and *O. myrsinioides*, F. Muell. (*Aster* of Labillardière), the Musk tree, of which there are two species, is of very moderate dimensions; the wood is mottled, has a pleasant fragrance, is tough, light in weight, and suitable for cabinet-work, turnery, &c.

Pittosporum. There are two kinds of this, commonly known as White wood; the trees attain medium size, the timber being of a yellowish colour, moderately hard, close in texture, suitable for engraving, turnery, and general purposes.

Tristania laurina, R. Br. A small tree found chiefly on river banks; the wood is very close-grained, tough, moderately hard when seasoned, good in quality, and suitable for carving, turnery, wheelwrights' work, and general purposes.

Victoria, like the sister Colony of New South Wales, is fairly provided with hard, useful timber, for constructive and other purposes; but has little or none to spare for export. If light woods easy to work are required, the Colony is probably dependent upon foreign supplies.

SOUTH AUSTRALIA.

The Timber Exhibits in this Court were by J. E. Brown, F.L.S., &c., Conservator of Forests, Adelaide, and consisted as per Catalogue of about thirty-eight neatly-prepared specimens of uniform size, placed upon a stand

convenient for public inspection; four planks shewn in the rough, and eight railway sleepers.

Of the exhibits I am about to describe, it will be seen that the *Eucalyptus* kinds are by far the most numerous; and of these strong woods many appear to be plentiful; probably there are more than sufficient for local purposes, but the difficulty with these will be to find a market for them, hard, heavy woods not being much in request at present anywhere. There are several woods suitable for furniture for home use, but they can scarcely compete with the mahogany of Honduras; hence, South Australia has very little for export, and being without light woods, such as fir and pine, for house-building, a supply of these can only be met by imports from abroad.

The descriptive account in the Catalogue of the "habitats" of the South Australian trees is all that can be desired, and this, combined with a careful survey of the exhibits, enables me to report individually upon some twenty-seven in number of the best in quality, these being in my judgment most suitable for constructive and other purposes.

Acacia. There are eight kinds of this genus in the Catalogue of Exhibits, namely, the Black, Silver, and Broad-leaved Wattles, Myall, Willow, Blackwood, Mulga, and a White or False Acacia, the latter being introduced to show how well the American Robinia grows in the Colony, where it is said to have attained in twenty years a diameter of 18 to 24 inches, yielding, as the sample shows, good timber of a chestnut colour. Of the Wattles, the Black and Silver are a little coarse in grain, but the Mulga is closer and finer in texture, moderately hard, and takes a good polish; these trees only attain moderate dimensions.

The Myall is a smaller tree, the wood dark brown in colour, violet-scented, moderately hard, and not heavy, is of considerable commercial value for making tobacco pipes. The Willow kinds appear to grow quickly, and are of moderate dimensions; the wood is brownish in colour, moderately hard, and good in quality.

The Blackwood variety is perhaps the best of its class, and attains moderate dimensions, the timber has a fine close grain, is hard, and takes a good polish. It is considered that all the Acacias are useful for the cabinet-maker, turner, coach-builder, and for general purposes.

Banksia marginata, Cav., Honeysuckle-tree. This is of small dimensions, the timber is dark, close-grained, moderately hard, and suitable by selection for furniture, carpentry, wheelwrights' and general purposes.

Bursaria spinosa, Cav., the Box tree, is of small size, the wood whitish in colour, hard, dense in texture, is fit for employment by the carver, turner, and wood-engraver.

Callitris cupressiformis, Vent., Native Pine or Camphor-wood tree, is of moderate dimensions, yielding timber yellow in colour, open-grained, soft, suitable for carpentry and wheelwrights' purposes. It is said to withstand the attack of white ants.

Casuarina, She Oak and Black Oak trees. These are small to medium in size, the timber reddish in colour, close in grain, moderately hard, of fair quality, and fit for furniture, wheelwrights' work, turnery, &c.

Erythrophlœum Laboucherii, F. Muell., the Ironbark tree, is of moderate dimensions, yielding, as per exhibit, a good sound reddish timber, very hard, heavy, and apparently not easy to work, but for

engineering purposes requiring great strength it would be of much value, as also for ship-building and architecture.

Eucalyptus. Of this genus there are ten timber-yielding species, five of which are met with in New South Wales, and eight in Victoria, the remaining two are peculiar to South Australia; hence the Red, Blue, Box, Sugar, Peppermint, Manna, and Messmate Gums, Stringy Bark, Head-flowered Stringy Bark, and Bastard Box, flourish in the Colony. It is remarkable that these Gums scarcely attain the noble dimensions of those of Victoria and New South Wales, but they are, nevertheless, fine trees of moderate dimensions, yielding straight timber of various shades from pale straw to dark brown colour, hard, heavy, strong, and durable. The two descriptions of Stringy Bark attain to somewhat larger dimensions than the Gums just referred to, and yield straight timber of a yellowish colour, hard, heavy, strong, and durable. The Bastard Box species is of more moderate dimensions than any of the others, each yielding good timber, light in colour, hard, heavy, and strong. It may be observed generally with reference to the *Eucalyptus* timbers that many have the defect of gum shakes between the annual layers; but if these are carefully avoided, much that is good can be obtained for furniture purposes, all the above-mentioned woods of the *Eucalyptus* class being suitable for engineering, architectural and millwrights' work, ship-building, and general purposes.

Melaleuca Leucadendron, Linn., and *L. squarrosa*, Sm., the Milkwood tree and the Bottle Brush Tea tree. These are of small growth, the timber of both being yellow in colour; the former has a wave or figure in the grain, would take a good polish, and would be suitable for furniture and general purposes. The Tea tree is considerably harder, and being denser in grain than the Milkwood would be useful in millwrights' and carpentry work, turnery, and possibly for wood-engraving.

Pinus halepensis, Ait. The Aleppo Pine is an exotic that grows rapidly in the Colony, and the specimen is exhibited to show the rapidity of its growth, as evidenced in its large open grain; the wood appeared light, soft, and easy to work, and suitable for house-building and carpentry generally. Having regard to the scarcity of light building timber in the Colony, it would be worth while to plant this Aleppo Pine extensively.

Further, the Commissioners for South Australia showed Myall wood, and Mr. John Dunn, Mount Barker, a Redgum plank, 15 ft. by 3 ft. by 2½ in., each of the exhibits being very good.

QUEENSLAND.

The main portion of the Timber Exhibits in this Court were by Mr. Fredk. Manson Bailey, Colonial Botanist, and were numbered in the Catalogue from 1 to 427; other exhibits were by Charles E. Adams, Goondi Plantation, North Queensland, Collection of Woods; Isaac Burgess, Mellum Creek, Two Logs of Cedar; James Fairlie and Son, Maryborough, Cedar Plank; Henry Friend, Sen., Gladstone, Collection of

Woods; J. W. W. Jackson and Company, Mitchell Maranoa, Planks of Bloodwood and Cypress Pine; Queensland Collieries Company, Howard, Polished Woods; and F. Strüver, Toowoomba, Sample boards of Cypress Pine.

The exhibits by the Colonial Botanist, being all conveniently placed for inspection, proved remarkably important as including a greater variety of species than any of the other Australian Colonies. The Catalogue gives full information of the "habitats" of the trees from which the specimens were obtained.

Following is a brief descriptive account of some 216 in number of the most valuable and best quality timbers for constructive purposes and furniture, the remainder consisting chiefly of trees of small size, some mere shrubs, palms and ferns, and a few woods that on survey appeared inferior in quality. It will be understood that among the trees not individually brought to notice, a large number are fit for local purposes. It may be that many persons who visited this Court and inspected the woods, considered them to be generally of a hard, heavy character; and this in fact is the case, there being scarcely any light woods for ordinary purposes in carpentry, such as fir or pine. There is a fairly good supply of hard, heavy timber, but probably not much to spare for export. Eventually, as the northern part of the Colony is opened out, large forests may be discovered, and a new source of supply obtained.

Acacia. There are per Catalogue twenty-nine varieties of this timber in the Colony, nine of the same being met with in New South Wales, five in Victoria, and four in South Australia. The Wattle varieties are the Silver, Black, Green, Hickory, and Ironwood; they are generally small trees, yielding timber of a dark colour, hard, heavy, and in some cases a little marked or figury. The Weeping and the Dalby Myall trees of this class are small. They yield a fragrant dark-coloured wood, nicely marked, close-grained, but not heavy. They are useful for many fancy articles and the manufacture of tobacco pipes. The Rosewood, Ringy Rosewood, and Brigalow, are tall trees, probably larger than the others. They yield timber of a dark colour, resembling the Rosewood of commerce. It is hard, heavy, and takes a good polish. The Wong-arrah, Mulga, and Yadthor are small trees; these and the above-mentioned are suitable for carpentry and wheelwrights' purposes, and by selection for furniture, turnery, &c. Further, there are sixteen that have no vernacular name, and being described in the Catalogue as small trees, it seems likely that most of them, although yielding hard wood of a close texture, are of little commercial value, except for local uses and ordinary purposes.

Albizzia. There are five species of this, but they are all without native or vernacular names, varying from small to moderate-sized trees, and yielding timber resembling cedar or walnut in appearance, two or three being nicely marked. They will be invaluable to the cabinet-maker for veneers and all kinds of furniture. They are also suitable for turnery, and for many kinds of ornamental work.

Alstonia. Of this there are five species, two of which attain moderate dimensions, and yield timber of a light colour, soft, and quite easy to work; very suitable for ordinary local purposes. The others, as *A. villosa*, Blume, yield a light-coloured wood, moderately hard, denser in grain; while *A. constricta*, F. Muell., known as the Fever Bark or Quinine

trees, has wood of a pale yellow colour, close in grain, hard, and suitable for cabinet-work.

Amoora nitidula, Benth. Is a tree of moderate dimensions, yielding timber of light colour, close in grain, hard, strong, fit for carpenters' and wheelwrights' work.

Angophora, "Apple" tree. There are four species of this, the largest being known as Rusty Gum, native name Toolookar; the others attain medium size only. They yield wood of a pinkish or grey colour, close in grain, moderately hard; well suited for carpentry, wheelwrights' work, and general purposes.

Araucaria Bidwilli, Hook., the Moreton Bay or Hoop Pine, native name Cumburtu or Coonam. There are two species of this tree, varying only slightly from each other. They attain medium dimensions, yield timber of a straw colour, often nicely marked, moderately hard, durable, and well adapted for carpentry and cabinet-makers' uses.

Baloghia lucida, Endl. A large tree, yielding timber of a yellowish colour, nicely marked, close in grain, hard, strong, and useful for cabinet-work, carpentry, and wood-engraving.

Banksia marginata, Cav., the Honeysuckle-tree, is in three varieties, attaining only to small-sized trees, and yielding timber of a reddish colour, prettily marked. It is moderately hard, and suitable by selection for cabinet-making, carpentry, and general purposes.

Barringtonia speciosa, Linn. f. A large tree of wide-spread habits, preferring the tropics, where it grows to the greatest perfection. It yields timber of a yellowish colour, hard, strong, likely to be durable, and fit for employment in architecture, wheelwrights' and cabinet-work.

Bauhinia Carronii, F. Muell., and *B. Hookeri*, F. Muell., Queensland Ebony. A tree attaining moderate size, yielding timber of a dark-brown colour, close in grain, hard; some of it, being nicely marked, is suitable for cabinet-work and a variety of purposes.

Beilschmiedia obtusifolia, Benth., the Sassafras tree. It yields timber of a straw colour, close in grain, easy to work, and fit for carpentry and general purposes.

Bridelia. Of this there are two species, attaining to moderate sized trees, and yielding wood of a dark or greyish-brown colour, close in grain, hard, taking a good polish, and suitable to the cabinet-maker.

Callitris. There are five species of this genus, one bearing the common name of Stringy Bark Pine, another Pooragri, and one Brorogery, two being without common names; some of these yield a flagrant straw-coloured wood, marked with streaks, and durable. They are suitable for piles, ship- and boat-building, being reputed to resist in a great degree the attacks of the teredo.

Calophyllum inophyllum, Linn., the Alexandrian Laurel tree. Tall and of moderate dimensions. A second variety is known as the Keena or Poon Spar tree; it yields the Poon Spars of commerce; is useful for engineering, architectural works, and many purposes. This, like the former, is red in colour, and takes a good polish, both being suitable for the joiner and cabinet-maker.

Carapa moluccensis, Lam. A tree of medium size, favouring the tropical coast, and yielding timber of a reddish colour, close grain, and nicely marked. It would be useful for furniture and many local purposes.

Carallia integerrima, DC. A moderate-sized tree, yielding light coloured wood, close in grain, easy to work for furniture or general purposes.

Cardwellia sublimis, F. Muell., Gold Spangle wood. A tree of large dimensions, yielding timber light in colour, suitable for cabinet-work.

Carnarvonia aralifolia, F. Muell., is of moderate size, and yields wood of a red colour, close in texture, fit for coopers' and cabinet-makers' work.

Castanospermum australe, Cunn. & Fras., the Bean tree or Moreton Bay Chestnut. A tall tree yielding timber of a dark colour, firm and close in texture, and suitable for turnery and cabinet-making.

Casuarina. There are seven timber-yielding species of this genus. One is the Swamp Oak tree, native name Billa, a medium-sized tree, yielding wood of a red colour, nicely marked, and close in grain, hard, and tough. Another with native name, Wunna-wunnarumpa, is of moderate size, yielding a light-brown wood, also nicely marked, close-grained, and very tough. Another, the Thready-barked Oak, of smaller growth, yields wood of a reddish colour, with dark shades of grain running through it, giving considerable figure. Then there is the Forest Oak, native name Koondeba, a tree of moderate size, timber of a red colour, very nicely marked, close in the grain, hard and strong. Further, there are three others of moderate size, each yielding a dark-coloured wood, nicely marked, close in grain, hard, tough and strong; the whole of these being available for use by coach-builders, wheelwrights, turners, cabinet-makers, &c.

Cedrela australis, F. Muell., the Red Cedar or Toon tree, native name Mamin and Woota. A very large tree yielding a beautifully grained red-coloured wood, easy to work, and said to be very durable. This will be found a valuable wood for cabinet purposes, and would be useful in many ways. It is in general use in the Colony.

Cupania. Of this there are five timber species, one at least being known by the native name of Tuckeroo. They all attain moderate size, yield timber of a light pinkish or yellow colour, close in grain, hard, tough, strong; very suitable for wheelwrights' work; would make good tool-handles, and be useful for general purposes. The specimen exhibited of *C. Pseudorhus*, A. Rich., being excessively sappy, would yield less workable wood in manufacture than the others.

Cryptocarya. There are six kinds of this, some being quite large trees, two are of moderate size only; the timber is generally light in colour, close in grain, and strong; would be useful to the wheelwright, carpenter, turner, and others engaged in manufacture for the domestic arts. The exhibit of one of the larger trees appeared excessively sappy, and inferior in quality.

Cynometra ramiflora, Linn. A tree flourishing in the swamps of the tropics; it is stated to be found also in the tidal forests of India and Burmah. It yields timber of a brown colour, close in grain, hard, heavy, but not difficult to work for carpentry, wheelwrights' work, or for cabinet-making.

Dammara robusta, C. Moore, Dundathu, or Kauri Pine. This is a tall tree, and doubtless attains considerable dimensions, yielding timber of a light yellow colour, close-grained, moderately hard, and easy to work,

This is found upon the coast, and should be valuable for use in architecture, cabinet-making, carving, and general purposes.

Daphnandra micrantha, Benth., is a moderate-sized tree, found in three varieties, yielding timber of a light colour, somewhat like Pine wood in one species, while in another it resembles English Holly; the wood of each is light in colour, close-grained, and possibly would be useful for carving, turnery, and wood-engraving.

Darlingia spectatissima, F. Muell. A moderate-sized tree of tropical growth, yielding wood of a light-brown colour, nicely marked, light, firm, fit for the cooper and cabinet-maker.

Diospyros. Of this there are two species, attaining in their growth to medium-sized trees, yielding timber of a yellow colour, close in grain, moderately hard and strong, suited to wheelwrights' work and carpentry.

Duboisia myoporoides, R. Br., is a small tree, the wood light yellow in colour, of close texture. This is probably suitable for carving and wood-engraving.

Dysoxylon Muelleri, Benth., is found in five varieties, varying in size from large to small trees; the wood is either reddish, or straw colour, frequently nicely marked, close in grain, and easy to work. It is known as Pencil Cedar, and would be very suitable for carpentry or cabinet-work.

Ehretia acuminata, R. Br., the Brown Cedar tree. This attains only small dimensions, yielding a light-brown wood, that is easy to work; its uses would be the same as *Dysoxylon.*

Elæocarpus. Of this there are four species, three of the number attaining large dimensions: one, *E. Bancroftii* (an undescribed species), in the specimen exhibited was exceedingly sappy; another, *E. obovatus*, G. Don, native name Woolal, appeared inferior in quality, and inclined to be shaky. Each of these trees yields timber brownish in colour, fine-grained, would be easy to work, and convertible for furniture and general purposes.

Eremophila. A kind of Sandalwood, of which there are three species shown, one scented and two scentless; they are small trees, yielding brown-coloured wood, hard, close in grain, and being for the most part of a fragrant character, available for the cabinet-makers' use and turnery.

Erythrina indica, Lam., and *E. vespertilio*, Benth., the Cork and Coral trees. There are two varieties. They appear to yield a very light straw-coloured wood, soft and easy to work, which would be useful for toy-making.

Eucalyptus. Of this there were at least forty-seven varieties exhibited, exceeding by ten the number from New South Wales, by twenty-three those from Victoria, by thirty-seven those from South Australia, and by thirty-nine those from Western Australia. Grouped collectively they stand thus: —Of the Gum variety there were nine, Ironbark five, Stringy-bark three, Blackbutt two, Box three, Yellow-jacket or Messmate two, Coolibar one, Jimmy Low one, and miscellaneous twenty-one. The vernacular names of the Gums are White, Blue, Grey, Swamp-Mahogany, Spotted, Iron, Poplar, Water, and Citron-scented. These are all large trees, yielding timber of a brownish colour, hard, heavy, strong, rigid, and durable—some are a little liable to gum-shakes, and one or more warp considerably in seasoning. Following these are Iron-bark, Large, Narrow, Silver-leaved, and Lemon-

scented. The narrow-leaved and lemon-scented are small, but the others are large trees, each, however, yielding timber of a grey or reddish colour, close in grain, hard, heavy, strong, rigid, and durable.

The Stringy-bark trees are smaller in size than the preceding, but large enough to yield considerable scantlings; the wood is of a greyish colour, moderately hard, and strong. The two varieties of the Woollybutt tree attain very large dimensions, yielding timber of a grey or pinkish colour, close in grain, moderately hard, heavy, and strong, but liable to gum-shakes. The Paroo and Stanthorpe Yellow-jacket trees are of moderate dimensions, yielding wood of a brownish colour, hard, and heavy.

The Box trees of the *Eucalyptus* class are the Poplar, Gum-topped, and Stanthorpe: these attain only moderate size, and yield wood of a greyish colour, close in grain, very hard; they would take a good polish. Jinbul, or Coolibar, is a small tree, yielding wood of a reddish colour, close in texture, very hard, and heavy. Jimmy Low is usually a large tree, yielding timber of a rich red colour, it has a fine grain, is moderately hard, heavy, and strong. All the above-mentioned *Eucalyptus* woods are suitable for engineering, architectural and wheelwrights' work, and ship-building; also by selection for cabinet-making and wood-engraving. Further, there are the miscellaneous kinds. A few of these attain large, a few others medium, but most of them only small dimensions; they scarcely compare favourably with the before-mentioned varieties for usefulness, but nevertheless possess a value in the Colony, which the builder and cabinet-maker will duly appreciate for their works.

Exocarpus. Of this there are two kinds, locally known as the Scrub Sandalwood, or Broad-leaved Cherry, and the Cypress Cherry. These trees are small, but yield fragrant wood of a dark colour; they might polish and be useful in cabinet-work, &c.

Flindersia. There are eight species of this, one or two are small, but the others are medium-sized trees; they all yield wood of a light or yellow colour, close-grained, moderately hard, strong, tough, and are considered durable. They will be useful to the cabinet-maker, and having the property of not being readily attacked by white ants, nor rusting iron, might be employed for many other purposes.

Gmelina, the Queensland Beech. Three species, two exhibited. They are tall trees, yielding wood of a grey colour, close in grain, moderately hard, and likely to be useful for wood-engraving, house-building, and many purposes.

Harpullia pendula, Planch., Tulip-wood. A tree of moderate dimensions, yielding wood of a dark colour, frequently finely figured, hard and tough, suitable for cabinet-work or wood-engraving.

Macadamia ternifolia, F. Muell. A tall tree, yielding wood of a reddish colour, close-grained, and prettily marked, suitable for cabinet-making and fancy goods.

Marlea vitiensis, Benth., Musk-wood tree. This is of moderate size, and yields wood of a dark colour, nearly black in the centre; the sap-wood yellow, it is close in grain, has a musk-like scent, and is very suitable for cabinet-work.

Melaleuca. The exhibits of this were nine in number, *M. Leucadendron*, Linn., being the largest; they all yield wood of a dark colour, close and

firm in grain, considered durable. It has been employed for piles, house-building, wheelwrights' work, and general purposes.

Melia composita, Willd., White Cedar. A large tree, yielding wood of a red colour, soft, light, easy to work, and, being abundant, it has a considerable commercial value for general purposes.

Podocarpus elata, R. Br., She Pine, native name Kidney-wallum. This tree grows tall, and yields wood of a light-yellow colour, close in grain, strong, durable; it fairly resists attack of the Teredo, and is useful for piles, spars, and masts for vessels.

Ratonia. Appears in two kinds. They are small trees, yielding wood of a light colour, firm, tough, suitable for tool-handles and, judging from the specimen exhibited, for carving or wood-engraving.

Rhus rhodanthema, F. Muell. A tall tree, yielding wood of a dark-yellow colour, fine in grain, polishes well, and is useful for cabinet-work.

Sideroxylon. There are four species of this, all being moderate-sized trees, yielding wood of a bright-yellow colour, close-grained, firm, suitable for building purposes and wood-engraving.

Siphonodon australe, Benth., Ivory-wood. A tall tree, yielding wood of a whitish colour, close in grain, firm, suitable to the cabinet-makers' use or for wood-engraving.

Spondias. This tree is of medium size, and yields wood of a dark-brown colour, with red shades of marking; the grain is close, and suitable for the cabinet-maker or turner.

Stenocarpus. The specimens exhibited are of two species—one being known as Tulip Flower, the other as Silky Oak—both being tall trees, yielding wood of a light colour, close grain, firm, and suitable for cabinet-work and general purposes.

Tarrietia Argyrodendron, Benth., &c. There are four specimens of this, two at least being known as the Stavewood tree; they are all of medium size, yielding wood of a light-grey colour, tough, firm, and considered to have some resemblance to both English Beech and Ash—being a good substitute for either, and suitable for carriage-work, tool-handles, &c.

Terminalia. There are seven species of this exhibited, each being of moderate size; the trees yield wood of a light-yellow colour, close-grained, nicely marked, hard, and suitable for cabinet-work, carpentry, turnery, and general purposes.

Tristania. Of this there are six species, one of which is known as Swamp Mahogany, native name, Boolerchu; these trees are all of moderate dimensions, yielding wood of a reddish colour, close in grain, hard, suitable for furniture, engineering works, and building purposes. It is said to resist the Teredo.

Villaresia (? *Smythii*, F. Muell.). A tall tree, yielding wood of a light colour, close-grained, prettily marked, and suitable for cabinet-makers' work, or for carving and wood-engraving.

Vitex Lignum-Vitæ, A. Cunn. Two species exhibited, the produce of large trees, yielding wood of a dark-brown colour, close-grained, hard, tough, suitable for cabinet-work, turnery, &c. This is scarcely equal in quality to the *Lignum-Vitæ* of commerce.

Wormia alata, R. Br. A tree of moderate size, yielding wood of a

dark-brown colour, close in grain, easy to work, and suitable for cabinet purposes. In appearance it is considered to resemble English Oak.

Xylomelum, Wooden Pear. There are two species shown, but both are small trees, yielding dark-red wood, close-grained, nicely figured, tough, durable, very suitable for cabinet-work, turnery, &c.

Zanthoxylum is shown in two varieties, known as Satinwood. They are small trees, possessing poisonous properties, yielding wood of a bright-yellow colour, close in grain, hard, heavy, and considered suitable for cabinet-work.

Private Exhibits.

C. E. Adams's collection (Catalogue, No. 123) included fair exhibits of woods of their class.

Isaac Burgess (125). Two logs of Cedar: one, 12 feet 10 inches in length, by 20 feet 5 inches in girth; the other, 12 feet 7 inches in length, by 18 feet 8 inches in girth. These, standing erect one on either side of the east end of the Court, attracted a considerable amount of attention from visitors, on account of their great size; they were in a round state, having only the bark off, except that a small part on one face had been dressed or flattened, and polished—to show how, in the hands of the cabinet-maker, the wood could be worked up for furniture purposes. Examining these carefully, it occurred to me that the magnificent trees or tree, from which these logs were cut, had stood until past the prime of life, and had some time since thrown off the bark, a little decay of the alburnum or sap-wood being observable near the base. Except for this, their top ends and exterior, which was nearly cylindrical, had a healthy appearance, and looked in good condition; hence they would yield a large quantity of serviceable timber for the cabinet-maker and manufacturer of fancy articles.

J. Fairlie and Son (127) exhibited a Cedar Plank of good quality.

H. Friend's collection (128) comprised fair exhibits of woods of their class.

J. W. W. Jackson (129) exhibited a Bloodwood Plank, 15 feet by 22 inches by 7 inches; also a Cypress Pine Plank, 14 feet by 18 inches by 5 inches, but neither were very good—the former being inclined to shake in the seasoning, and the latter excessively knotty.

WESTERN AUSTRALIA.

The Timber Exhibits in this Court were by the Commission of Western Australia, Western Australian Commission, Western Australian Manufacturing Company, Perth; Albany Local Committee, Bunbury Local Committee, Carnarvon Local Committee, Perth Local Committee, Vasse Local Committee, York Local Committee; Clarkson, B. D., Newcastle; Davies, M. C. Augusta, Dunne Bros., Hassell, A. and A., Kendenup; Keane and White, McKail, J., Albany; Muir, A., Albany; Neil, McNeil and Company, Jarrahdah; Sheratt, T., Albany.

Thus there were eighteen contributors, but a smaller variety of timber

exhibits than either of the other Australian Colonies. The chief and most important of the exhibits were the Jarrah, Karri, and Tuart timbers, of which the two former are plentiful, the other moderately so. These woods are available for export to almost any extent, and likely to be drawn upon largely for constructive purposes, from their known strength and durability. Good furniture woods are scarce, and there is no fir or pine, for the lighter works in carpentry, found in the exhibits from the Colony. The report covers the whole of the exhibits.

Acacia acuminata, Benth. This is the Raspberry Jam tree of the Colony, and is of small dimensions, yielding a hard, fragrant scented wood, suitable for cabinet-making, though, so far as can be seen, it is only used for fencing posts on account of its durability. A slab cut eighteen years ago—quite sound now—and a small log served to represent this tree.

Agonis. Boat crooks from the Peppermint trees were shown of a species of this genus, which appeared suitable for the purpose.

Banksia verticillata. The trees of this are of moderate dimensions, and yield a soft mottled wood, tough, elastic, and easy to work. It is suitable for joiners and cabinet-makers for furniture purposes; also for boat-building. Two sections and two slabs exhibited represented this wood.

Casuarina, the She Oak and Swamp Oak trees. They are of medium size and yield timber of a reddish colour, moderately hard, tough, and elastic. They are considered equal, if not superior, to Hickory for tool-handles and wheelwrights' work.

Eucalyptus. Of this eight species were exhibited, viz.:—(1) *E. calophylla*, R. Br.; (2) *E. cornuta*, Lab.; (3) *E. diversicolor*, F. Muell.; (4) *E. gomphocephala*, DC.; (5) *E. longirostris*, F. Muell.; (6) *E. loxophleba*, Benth.; (7) *E. marginata*, Sm.; (8) *E. redunca*, Schau. None of these were found in the exhibits of the other Australian Colonies. Nos. 1, 2, 5, and 6, respectively known as Red Gum, Yate, Morrel, and York Gum, each attain moderate size, yielding timber of a hard, tough, strong, and heavy character, suitable for engineering and architectural works. (8) The Wandoo is less tall than those previously named, and has its stem commonly in twisted form; the wood is pale in colour, very hard and durable, is suitable for mill cogs, wheelwrights' work, and rough carpentry; but on account of its peculiar growth, it probably would not be suitable for engineering purposes. (3) Karri is one of the noblest trees of the Western Australian forests; it grows to a great height, and has no rival, except the *E. amygdalina*, Lab., of South-East Australia, in the Australian Colonies. It is scarcely rivalled by the *Pseudotsuga Douglasii*, Carr., of British Columbia, or the *Sequoia gigantea*, Decne., of California. These magnificent Karri trees grow perfectly straight and cylindrical, frequently free from branches to 80 feet, and yield timber of a reddish colour, clean and straight in grain, hard and heavy, scarcely free from gum veins, and liable to split in seasoning. Two specimen logs, each about 51 feet in length, free from knots, and straight in grain, stood upright, one on either side of the north-east entrance to the Court; while close by a stack or pile of square or converted timber was lying tier upon tier horizontally, some portion of these being of scantlings suitable for railway sleepers; these are doubtless of the best quality the trees yield, and treated as fair samples, may be regarded as suitable for engineering purposes, bridges, piles,

architecture, and by selection for ship-building and cabinet-making. Karri has the reputation of being durable, and is lighter in weight than Tuart or Jarrah. (4) Tuart. This is a tree of large dimensions, but it does not grow to nearly the same height as the Karri; it yields timber of a straw colour, curled or twisted in the grain, is hard, strong and durable, heavier than most trees of *Eucalyptus* class, and being difficult to cleave, does not split as many others in seasoning; further it appears to be without gum-vein defects. Owing to the solidity of its character, and general good properties, it is invaluable for all kinds of engineering and architectural works, for cabinet-making and turnery. The plank exhibited, cut eight years, and the slab Tuart are in good condition. (7) Jarrah. This tree is spread over a wide range; it is stated to occupy as much as 14,000 square miles of the country, or nearly equal to one-half of the forests in the Colony. It attains large dimensions, yields timber of a reddish colour, in which occasionally gum veins are found; is hard, heavy, moderately strong, and durable, as the exhibits and the information obtainable show very satisfactorily. A whole trophy of square or converted timber of this class stood piled horizontally tier upon tier, in the open near the north-east door of the Court; also a log set vertically in the round state, while another log in the round, stated to measure 116 cubic feet, lay just within the door, having part of its side dressed or flattened and polished; one, the exposed end, not showing the heart-shake, if any, also being polished to show how from the rough and natural appearance of this timber it can be improved upon if put into the hands of the cabinet-maker. Much has been said at times in favour of the Jarrah, but all who have a knowledge of its properties admit its liability to split seriously in seasoning, unless extraordinary precautions are taken to have the trees cut from hilly localities, and in the season when the sap is least active.

It is peculiar to the Jarrah that while it continues to grow and thrive, and long before it matures, decay sets in at the heart or pith of the trees, wastage commences, and, from the root for some distance up the stem, the tree becomes hollow. Those working the forests do not regard this as of much importance; they advise rather that no square log to the full size of the tree should be attempted, but instead thereof to take the largest size obtainable, in flitches clear of this defect. Having regard to this, I consider that where the trade conditions as to selection and felling are strictly observed, this timber is suitable for piles, bridges, railway sleepers, architectural works, ship-building, and general purposes. It is said to be impervious to the teredo and termiles, and to be of a non-inflammable character.

The slab, the small pile, and the pieces of Jarrah fencing post, are satisfactory evidences of the durability of this timber.

Fusanus spicatus, R. Br. The selection of Sandalwood exhibits were pieces taken from trees of small dimensions; they yield a fragrant wood, much in demand for trade with China.

Melaleuca sp., Tea tree, or Paper-bark tree, is of moderate dimensions, rising in some instances to 100 feet or more; it flourishes best on river banks, and yields a hard useful timber, that resists the white ants. It would be suitable for building purposes.

NEW ZEALAND.

The Timber Exhibits of this Court were by Aiken, W., Wanganui; Auckland Timber Company; Boyd and Edwards, Southland; Campbell, J. Logan, Auckland; Dawson and Sons, J. H., Invercargill; Tapper, A., Invercargill; Union Sash and Door Company, Auckland; Waddell, McLeod and Weir, Wellington; Wilding and Company, Hawke's Bay; Public Works Department, and Government of New Zealand.

The Catalogue referring to the exhibits by the Government is not alphabetically arranged, either for botanical or native names. It includes 178 specimens; but of these there are only fifty-eight varieties, the others being made up of duplicates, &c., of the same descriptions of wood, probably brought from different localities.

A portion of these were set up in trophy form in the centre of the Court, the remainder were placed against the wall dado fashion in the Fernery, both parcels making an effective display, and attracting, by their variety of shade and colour, many visitors who passed through the Court. The several parcels sent in by private exhibitors were good, and fairly represented the woods of the Colony. I give a detailed and descriptive report, of some twenty in number, of the best in quality, and most important, observing that besides these there were, in my opinion, many others only a little less valuable.

The five best timbers are the Kauri Pine, Puriri, Rata, Rimu, and Totara. The first-mentioned is abundant in the North Island; the others are only moderately plentiful in both North and Middle Islands. To some extent these woods are available for export; also a few others of somewhat less note, suitable for works of construction and furniture purposes, might be spared in moderate quantities, if a demand arose for them.

Dacrydium. There were two of this class exhibited, viz.: the Manoao, Yellow or Golden Pine, *D. Colensoi*, Hook., growing in North and Middle Islands, the wood is hard, strong and durable, it would be useful for furniture and general purposes; and the Rimu, or Red Pine, *D. cupressinum*, Soland., a graceful and ornamental tree of large dimensions, found wide-spread over the Colony; its wood is reddish brown in colour, resembling rosewood, heavy, and takes polish, it is suitable for architectural and engineering works, cabinet-making, and a variety of purposes.

Dammara australis, Lamb., Kauri. A majestic coniferous tree, found abundantly in many of the forests in the Auckland district. It is of straight growth, and tall enough, clear of branches, to make masts for ships of considerable burthen. The wood is pale straw colour, moderately hard, works up with a silky lustre, takes a good polish, and is fitted in every way for use in architecture, for furniture, and any conceivable object in carpentry, turnery, carving, and general purposes. This tree flourishes best in sheltered valleys, and up the hill sides, but at the outskirts of the forest, upon high ground, it takes only a stunted form of growth. The cross section exhibited was very solid, and measured about 45 inches in diameter, the sapwood being about 5 inches thick, which is the average quantity found on healthy, vigorous trees of this diameter, while upon small trees it is much thicker. The Kauri yields a gum of great commercial value for the making of varnish, and in 1884 it is said

that 6,393 tons, valued at £342,151, were exported; large quantities were also exported in the previous years, chiefly to America. It is very remarkable, however, that the gum is obtained, for the most part, in the open country, where no forests at present exist, and is dug up from various depths beneath the surface of the ground. It is observed that only old trees, past their prime, yield the gum in any noticeable quantity, and I estimate that probably not 500 tons could be obtained from trees now standing in the forests.

Fagus. Of this, there are three varieties, known as Red, Black, and White "Birch," from the colour of the bark; it grows at considerable altitudes, and is found wide-spread over the Colony. The wood is moderately hard, straight-grained, and of light weight; it is suitable for engineering and cabinet-work.

Knightia excelsa, R. Br., the Rewarewa. A tall tree of medium size, found in the Northern Island; the wood is mottled red and brown, moderately hard, takes a good polish, and is fit for furniture and many purposes.

Leptospermum. There are two of this class: the Manuka, *L. ericoides*, A. Rich.; and Kahikatoa, or Tea-tree, *L. scoparium*, Forst.—found generally in the larger islands, but being small trees, the wood can only be employed for local purposes.

Libocedrus. Of this, two species were exhibited. The Pahautea, *L. Bidwillii*, Hook. f., found in both North and Middle Islands, growing at considerable altitudes, is of medium size, the wood is reddish in colour, moderately hard and heavy, works easily, and is suitable for carpentry or furniture. The Kawaka, *L. Domiana*, Endl., is also a tree of medium size, the wood is reddish in colour, fine, straight-grained, heavy, and suitable for carving or furniture.

Metrosideros. There are two of this genus, viz.: the Pohutukawa, *M. tomentosa*, A. Cunn., found only on the rocky coasts, where it assumes a crooked form of stem and branches: the wood is dark in colour, close in grain, hard, heavy, suitable for framework of wood-built ships; and the Rata, *M. robusta*, A. Cunn., a tree which attains large dimensions, the wood being red in colour, hard, heavy, strong, and of a durable character, fit for piles, bridges, and generally for engineering and architectural works, and for furniture.

Phyllocladus. There are two of this genus: the Tanekaha, *P. trichomanoides*, G. Don, a Celery-leaved Pine, of medium size, the wood pale straw colour, close-grained, moderately heavy, strong, and fit for spars, planking, and generally for carpentry: it is found in the forests of the Northern Island, and is likely to be durable; the other is the Toatoa, *P. alpinus*, Hook. f., a small tree, the wood fit for furniture.

Podocarpus. Of this, there are four species found growing in the North and Middle Islands, viz.: the Kahikatea or White Pine, *P. dacrydioides*, A. Rich., which is found only on low grounds, and attains there noble dimensions: the wood is whitish, soft, light, and not being considered durable, chiefly valuable for local purposes; the Matai, *P. spicata*, R. Br., and Miró, *P. ferruginea*, G. Don, both known as Black Pine, are of wide-spread growth, and medium size: the wood is yellow in colour, close-grained, moderately hard, and suitable for cabinet purposes and architecture; the Totara, *P. Totaro*, A. Cunn., is moderately abundant in the

Colony, attains large dimensions, and yields a very useful timber: the wood is reddish in colour, close and straight in the grain, takes a good polish, and in appearance resembles mahogany, but is generally plain in character: it is suitable for architectural work, cabinet-making, and very generally in the domestic arts. The natives say canoes made of this wood are very durable.

Vitex littoralis, A. Cunn., the Puriri tree. Is of moderate dimensions, grows in the Northern Island, is stout, and yields good scantlings for engineering and architectural work; it is also suitable for furniture, the wood is brownish in colour, hard, heavy, and considered durable.

FIJI.

The Timber Exhibits in this Court were by C. R. Swayne, twenty-two samples of different woods; The Commissioners of Lands, pieces of Bandina boxwood; and The Government of Fiji, seventy-one samples of different woods.

The Government timber exhibits were stout boards of about two feet in length, by the full breadth of the trees from which they were taken. This was a very great advantage, as the Catalogue gave no information. The Hon. James E. Mason, however, was good enough to supply a list in manuscript of the timber exhibits, with the Fijian names, botanical names, and remarks upon the greater number of them, but not the *habitats* of the trees. The exhibits were admirably arranged in the Court for display, and from their appearance I am able to report that a few of the timbers, as Cavuna-Tabua, Dakua, Dakua-salusalu, Damanu, Vaivai, and Vesi, are very good, and include them in a descriptive account of twenty-eight in number, of the best; observing that among the remainder are some not far below them in quality, and a few that are doubtless of little value, except in the locality where they are found.

Exhibits Botanically Named.

Acacia Richii, A. Gray, native name Qumu.

Afzelia bijuga, A. Gray, Vesi, and *Alphitonia excelsa*, Reiss., Doi, are two timbers of good appearance, the former being a good furniture wood, while the other would be suitable for carpentry and general purposes.

Calophyllum Burmanni, Wight, and *C. inophyllum*, Linn., Damanu and Dilo. Of these the former yields timber of a large size, hard and heavy: the other is smaller, light brown in colour, nicely veined in grain, moderately hard, and heavy; both being good in quality, they are suitable for the cabinet-makers' use and building purposes.

Casuarina, Caukalou and Caukuru. There were two of this genus, the former attains large dimensions, and yields timber of a dark-brown colour, beautifully veined in grain, moderately hard, and capable of a good polish: the other scarcely varies from it; both would be suitable for furniture, wheelwrights, and carpentry purposes.

Dacrydium elatum, Wall., and *Dammara vitiensis*, Seem., Dakua-salusalu and Dakua. These are trees yielding timber of large dimensions, of a brownish colour, moderately hard, and suitable for engineering purposes. The Dakua is considered similar to the New Zealand Kauri, although in colour and texture I failed to see the resemblance.

Euphorbiaceæ, Bau Loa and Bau Vudi. There were two exhibits of this natural order; both trees are of moderate dimensions, yielding timber of a dark-brown colour, hard, heavy, and suitable for building purposes and furniture.

Guettarda speciosa, Linn., Buabua. A tree of large dimensions, yielding timber of a dark colour, hard and heavy; is suitable for engineering purposes.

Lumnitzera coccinea, Wight & Arn., Sigali. A tree of moderate dimensions, yielding a hard, heavy, strong timber, suitable for piles or wharfs, as it withstands the Teredo.

Metrosideros sp., Vola, yields a dark-coloured wood, suitable for furniture.

Nephelium pinnatum, Camb., Dawa; and an *Olacinea* (? *Stemonurus vitiensis*, Seem.), Yaduvu. Both yield timber suitable for carpentry, wheelwrights' work, turnery, and cabinet-making.

Podocarpus cupressina, R. Br., Cavuna-Tabua; *Pongamia glatra*, Vent., Vesivesi; and *Premna taitensis*, Schau., Ceona. These are trees yielding timber of a light colour, that appears to be good in quality, and suitable for furniture and carpentry purposes.

Pterocarpus indicus, Willd., Cibicibi; and *Serianthes vitiensis*, A. Gray, Vaivai. The former yields timber of a dark colour, hard, heavy, and strong; the latter is a yellowish-coloured timber, with a nice wave or figure in the grain, hard, moderately heavy, both being suitable for furniture.

Exhibits not Botanically Named.

Calavia and Cara. These trees yield timber of a hard, strong character, that would be suitable for building purposes and cabinet-making.

Mena. A chestnut-coloured timber, moderately hard and heavy, suitable for furniture.

Rantu and Rosawa are two good descriptions of timber: the former is of a yellowish colour, close-grained, strong and elastic, it might make boat oars; the other is of a darker colour, hard, heavy, tough, and suitable for carpentry and wheelwrights' work.

Sacau. A tree of moderate dimensions, yielding a hard, strong timber, which is said to resist the Teredo. It would therefore make piles for wharfs, and be suitable for many engineering purposes.

Sarosaro is a dark-brown coloured timber, hard, strong, and heavy. It might be used for the same purposes as Sacau.

I noted C. R. Swayne's twenty-two samples of different woods, and the Hon. the Commissioner of Lands' pieces of Bandina Boxwood as being very good.

Fiji possesses beyond many other Colonies a wealth of timber suitable for constructive and furniture purposes; and there is a source of supply open there, which might be drawn upon if required. Should this occur, the receipts in aid of revenue would be considerable.

CAPE OF GOOD HOPE.

The Timber Exhibits in this Court were by the Railway Department, specimens of Colonial wood, 13 sleepers after 3 to 21 years' wear; and by the Forest Department, Capetown. The Catalogue shows that these include (Nos. 1 to 66) woods from Knysna and Eastern Forests, and (Nos. 69 to 87) indigenous woods from the West and North of Cape Colony, and naturalised and introduced trees.

The timber exhibits were planks about two feet in length, by the breadth of the trees from which they were taken; also some round sections, all being conveniently placed for inspection. The Catalogue referring to these, arranged according to economic and forestal importance, was ample for guidance, and having identified the woods with this, I concluded from their appearance that the trees generally attain only moderate size, very few being of large dimensions; none seem hard or difficult to work or of heavy weight. Consequently they are useful for architectural work and engineering purposes, for piles and bridges, &c., requiring only moderate-sized scantlings for their construction. There are a fairly good number of trees with coloured and figured wood suitable for furniture, but there is no evidence that the timber is sufficiently plentiful in any part of the Colony to spare for exportation.

I give an account of twenty-nine of the best woods, including Assegai wood, native name Umguna; Black Iron-wood, Igqwanxe; Stink-wood or Laurel-wood; Yellow-wood, Umkoba and Umceya; Sneeze-wood, Umtati; observing that beyond the number in the descriptive list, there are apparently many others possessing commercial value for local purposes, but which for want of space cannot be particularised.

Acacia. There were four varieties of this class exhibited. They attain only moderate size, and yield wood of a dark colour, hard, tough, and suitable for wheelwrights' work, tool-handles, &c.

Atherstonea (? *Canthium* sp.), Kajatenhout, is known locally as Cape Teak, or Cape Oak. The trees are moderate in dimensions, and yield a yellowish-coloured wood, hard, heavy, tough, and well suited to wheelwrights', coopers', and rough carpentry work.

Brabejum stellatifolium, R. Br., the Red Stink-wood tree, attains moderate dimensions, yielding a dark-coloured wood, which by the specimens exhibited appeared very good in quality. It is suitable for wheelwrights' and cabinet-makers' uses.

Buddleia salviæfolia, Lam., the Salie-wood tree, Umkaya. It is small in dimensions, yielding a hard, tough wood, with a wavy or figured grain. It appears suitable for millwrights' work, cabinet-making, and wood-engraving.

Buxus Macowani, Oliv., Boxwood. This is a small tree found chiefly in the coast forests of East London, where it is very plentiful. It yields wood of a dense texture, hard, and heavy; possibly this may prove to be a good substitute for the Box of commerce.

Calodendron capense, Thunb., the Wild Chestnut. A deciduous tree, attaining medium dimensions. It yields a light-coloured wood, moderately hard, tough, and strong. It is stated to be used for wagon wood, and by natives for sledges, for which it seems well adapted. The specimens exhibited appeared good in quality, except that a cross fracture was noticed

in one, that would militate against its use for architectural work, if this defect is common in it.

Cunonia capensis, Linn., the Red Els tree, Umgwashube. A tree of moderate dimensions, yielding timber of a rich red colour, hard, tough, and not heavy. One of the specimens exhibited had a rather cross grain, the wood being inclined to split; it was excessively sappy, and appeared inferior in quality. This would be useful for furniture, wagon-building, and other purposes.

Curtisia faginea, Ait., the Assegai tree, Umguna. This tree attains a large size, yielding timber of a bright-red colour, close-grained, very tough, and strong. It would be suitable for spokes and felloes, tool-handles, and for cabinet-making.

Eckebergia capensis, Sparrm., the Cape Ash, Umgwenyuizinja, is found at great elevations, attains moderate dimensions, and yields wood of a straw colour, soft and easy to work. It is inferior to, but in appearance resembles European Ash timber. It is suitable for wheelwrights' work and cabinet-making.

Elæodendron croceum, DC., the Saffron-wood tree, Umbomvana. It is of moderate dimensions, and yields timber of a dark shade of colour, resembling walnut-wood. It takes a good polish, and is suitable for furniture, boat-building, wheelwrights' work, and general purposes.

Eucalyptus globulus, Lab., the Australian Blue Gum. This tree was introduced into the Colony fifty-eight years since, and is now regarded as naturalised; it apparently thrives well, attains large dimensions, and yields timber of a brownish colour, hard, heavy, very strong, and durable. It is suitable for ship-building, agricultural, and general purposes.

Euclea. There are four varieties of this class, two of the best being known as Cape Ebony and Quar. As trees they barely attain moderate dimensions. The Cape Ebony wood, being jet-black and hard, would doubtless be useful for a variety of fancy and ornamental purposes. The Quar yields timber of a brownish colour, is close-grained, very hard and heavy, frequently grows knarled, which imparts a wave or figure to the grain, and hence it would be suitable for furniture, and possibly for wood-engraving.

Gonioma Kamassi, E. Mey., Kamassi, a species of Boxwood. A tree of small dimensions, yielding a very hard, close-grained wood, suitable for wheelwrights' work, turnery, tool-handles, and some carpentry. The specimens exhibited showed it to be of good quality. Its value as a substitute for true or real box, for wood-engraving purposes, if fully recognised, would enhance its commercial value.

Laurus Camphora, Lam., the Camphor tree. This is not a native, but being now well acclimatized, it yields wood of a light colour, moderately hard and heavy; judged by the specimens exhibited it is good in quality, and admirably suited for the cabinet-makers' and turners' uses.

Ochna arborea, Burch., Redwood tree, Umtensema. A small tree, that yields a close-grained, hard, strong wood, easy to work. It would be very suitable for turnery, tool-handles, carving, and wood-engraving. The specimens exhibited appeared equal to true Rosewood.

Olea laurifolia, Lam., and *O. capensis*, Linn., Black Iron-wood and Wild Olive-wood, Igqwanxe and Umguma. There are thus two varieties, each attaining moderate dimensions: the former, yielding a dark-coloured

wood, streaked or figured in grain, and taking a good polish, is suitable for furniture, and also for agricultural works; the Olive tree is somewhat smaller, and yields timber of a striped or figured character, close in grain, hard, heavy, and durable: it is suitable for cabinet-making, wheelwrights' work, and general purposes.

Ocotea bullata [J. Jackson], Stink-wood or Laurel-wood. A tree of large dimensions, yielding timber of a moderately hard texture, resembling Teak, to which it is said to be nearly equal. It possesses great strength and durability, is suitable for engineering, architectural and wheelwrights' work, and also makes good furniture.

Platylophus trifoliatus, G. Don. Is a tree of moderate dimensions, yielding wood of a yellowish colour, close in grain, hard, tough, of moderate weight. Some figure was observed in the grain of a specimen exhibited, and as this would take a good polish, it would be suitable for furniture and many other purposes.

Podocarpus elongatus, L'Hér., and *P. Thunbergii*, Hook., Outeniqua Yellow-wood, Umkoba, and Upright Yellow-wood at Knysna, or Real Yellow-wood at Amatolas, Umceya. There are thus two species, the former attaining to the largest dimensions of any trees in the Colony, the latter to the dimensions of a moderate-sized tree only. The Outeniqua yields good timber of a yellowish colour, close in grain, and moderately hard, which would take polish, and be suitable for the cabinet-makers', civil architects', and wheelwrights' use. One specimen of the Upright Yellow-wood exhibited indicated a liability to split, except for this it seemed otherwise good in quality. It is of a yellowish colour, moderately hard, and, like the Outeniqua, suitable for house-building, wheelwrights' work, &c.

Ptæroxylon utile, Eckl. & Zey., Sneeze-wood, Umtati. This is considered one of the most valuable trees of the Colony, and is found upon the plains, but requires a dry elevated position to bring it to the greatest perfection. It yields a very hard timber, which is reputed to be durable. The specimens exhibited showed it to be of good quality, with a moderate amount of sap-wood. The timber is suitable for engineering, civil architecture, wheelwrights' work, and cabinet-making. It is said the White Ant and Teredo will not touch it.

Sideroxylon inerme, Linn., White Milk-wood, Umgwashu. A small tree, yielding wood of a whitish colour, hard, tough, and heavy. Judging from the specimens exhibited, this would be suitable for carving or wood-engraving.

The Cape of Good Hope is only barely furnished with timber; its hard and soft woods seem insufficient to meet local wants; and if any extraordinary works were required to be carried out, the Colony would be dependent upon foreign supplies to meet them.

NATAL.

The Timber Exhibits in this Court were by G. H. Rennie, 5 in number; Marcus Moxhan and Company, Swansea, case of 20 specimens

of wood; William Geere, Pietermaritzburg, 3 frames, containing 26 specimens of wood; William Bazley, Lower Umzimkulu, 27 cross sections of timber trees; R. G. Hooper, near York, 11 cross sections of timber trees; and Natal Commissioners, 82 in number — making a total of 171.

Of the above-mentioned exhibits, it may be said they consisted for the most part of narrow thin pieces measuring about 3 by 12 inches, some being in frames. The names could easily be taken from these for comparison with the Catalogue. This, however, is exceedingly bare of information about the trees of the Colony. The quality of the timber could be determined upon inspection, but in many instances it was hardly possible to judge whether they were produced from small or large trees. Mr. Bazley's and Mr. Hooper's cross sections were nearly all of small diameter, and not of great service for elucidating the matter.

As it is tolerably clear that the trees of Natal are generally only of moderate dimensions—almost none being large—and the names they bear being in many cases the same as those of the Cape Colony, I have referred to them for comparison in this report. Presuming that this idea is correct, it may be stated generally that at Natal there are woods suitable for works of construction, and also in some degree for furniture purposes. A descriptive account of a few of the best woods is appended, including Assegai-wood, Black Iron-wood, Sneeze-wood, Stink-wood, and Yellow-wood.

Curtisia faginea, Ait., Assegai-wood. This tree is the same as the Umguna of the Cape Colony, and appears to grow to a large size, yielding timber of a bright-red colour, close in grain, very tough, and strong. It is used by the natives for making their implements of war, and is suitable for spokes and felloes, and for furniture.

Celtis Kraussiana, Bernh., the Soft Grey or Camdeboo Stinkwood tree, known at the Cape Colony as Umvunuri, yields timber of a dark greenish colour, with a vein or figure in it. It is hard and heavy, takes a good polish, and would be suitable for furniture, wheelwrights' work, and rough carpentry.

Eckebergia capensis, Sparrm., the Essen-wood or Ash tree, known at the Cape Colony as Umqwenyuizinja. This tree appears to attain moderate dimensions, and yields timber of a straw colour, soft, and easy to work; but the quality is inferior. It would be suitable for rough carpentry, and wheelwrights' work.

Ocotea bullata [J. Jackson], Hard Black Stinkwood tree. This probably attains large dimensions, yielding timber of a moderately hard texture, brown in colour, resembling Walnut or Teak, for which it is considered a fair substitute. It is suitable for furniture, engineering, and architectural purposes. The Soft Grey and White Stinkwood trees are believed to be varieties of the Hard Black above referred to.

Olea laurifolia, Lam., Black Ironwood, is known at the Cape Colony as Igqwanxe. It attains moderate dimensions, and yields timber that is close-grained, firm, and heavy; stronger than Sneezewood, and suitable for wheelwrights', turners', and carpenters' work.

Podocarpus elongata, L'Hér., the Yellow-wood tree, of which there are two varieties, the Red and White, known respectively at the Cape Colony as Umceya and Umkoba. They are large trees, yielding logs 40 feet long and 5 feet diameter. The timber is in general use for building purposes,

and for the commoner kinds of furniture, but does not stand exposure for outdoor work.

Ptæroxylon utile, Eckl. & Zey., Sneezewood, known at the Cape Colony as Umtati. So called from the irritating dust it gives off in working. It is a large tree, yielding occasionally logs 80 feet long and 4 feet diameter. The timber has a beautiful grain, resembling that of Satinwood; but is extremely hard, and not easy to work. It is said to be very durable, and is doubtless suitable for engineering, carpentry, cabinet-making, and general purposes.

Scolopia, the Red and Thorn Pear trees. They attain moderate dimensions, yielding timber of a very hard and firm character; suitable for teeth for mill-wheels, wheelwrights' work, turnery, and furniture.

Sideroxylon, Milkwood trees, White, Soft, and Greasy. There being three species of this, generally attaining only moderate dimensions, yielding a whitish wood, moderately hard and strong. It would be useful for wheelwrights' work and boat-building.

Toddalia lanceolata, Lam., White Ironwood, known at the Cape Colony as Umzani. It attains medium dimensions, and yields a moderately hard, tough variety of wood, elastic, and suitable for wheelwrights' work, turnery, and general purposes.

Natal has only a moderate supply of timber in the Colony; if any heavy demand were to arise for new works of construction, it would be dependent upon foreign supplies.

CEYLON.

The Timber Exhibits of this Court were by the Director of the Royal Botanic Gardens, 240 in number; the Government of Ceylon, planks of useful or ornamental timbers; Captain M. W. Skinner, R.E., a collection of 100 small specimens of Ceylon woods; Don Henric Lokuderendana, Galle, a box of small samples of Ceylon woods.

The exhibits of the first-mentioned parcel consisted for the most part of short cross sections, about 15 inches in length, cut transversely for the base, and slopingly for the apex, the names being painted legibly on this part. The main portion of these exhibits were piled twelve tiers high in two parcels at the western corners of the Court, in form like the vertical quarter section of a pyramid, making a grand display; and except for the difficulty of inspecting and reading off the upper ranges, it was a happy design.

Some planks of Calamander, Gal-siyambala, Jak, Nédun, Pamburu, Sapu, Satinwood, Tamarind, and Wa were placed against the wall dado fashion, and these being choice furniture woods, admirably set off the whole. The Catalogue was arranged alphabetically for botanical names of the timber exhibits, but gave no information of the *habitats* of the trees. This deficiency was however met by Dr. Trimen, who kindly lent me a pamphlet on the timber trees of Ceylon, which enabled me to make satisfactory progress.

A brief descriptive account of some of the best timbers is appended.

Adenanthera pavonina, Linn., native name Madatiya. This is a medium-sized tree, yielding a close-grained, hard, strong timber, with a fragrant scent; and as it takes a good polish, it is suitable for furniture and carpentry.

Albizzia odoratissima, Benth., Suriya-mara. The specimen exhibited had been taken from a small tree, but in growth it attains moderate dimensions, and yields wood of a reddish-brown colour, with dark veins, hard, of moderate weight, and is considered durable. This would be suitable for furniture and wheelwrights' purposes.

Artocarpus integrifolia, Linn., Kos or the Jak tree, is of large dimensions, and yields timber that is nicely marked in the grain, being moderate in weight, and taking a good polish, it may be regarded as a valuable timber, suitable for ornamental and furniture purposes.

Atalantia missionis, Oliv., Pamburu. A tree of large dimensions, yielding timber of a yellowish colour, close-grained, moderately hard, taking a good polish, and suitable for furniture.

Bassia neriifolia, Moon?, Mi-Gaha. This is a tree of moderate dimensions and plentiful. It yields timber of a yellowish-brown colour, hard, heavy, close-grained, flexible, and suitable for ship-building, wheelwrights' work and for furniture. It is considered scarcely inferior to Teak in strength.

Berrya Ammonilla, Roxb., Hal-milla. This is of nearly equal value to the Kos or Jak tree. It yields a light-red coloured wood, straight-grained, tough and flexible. It is suitable for carriage- and house-building.

Bridelia retusa, Spreng., Kéta-Kala. The wood of this tree is reddish in colour, close-grained, heavy, rigid, and very strong. It is useful for house-building, wheelwrights' work, and general purposes.

Calophyllum Burmanni, Wight, Guru-kina. A tree of large dimensions. It is considered that the famous Poon spars of Western India are the product of this tree; consequently there must be good scope for the employment of this timber in Ceylon, in the same way, or for furniture and general purposes.

Carallia integerrima, DC., Dawata. This tree yields an ornamental timber of a reddish colour, with a wavy appearance of grain, is very tough, and not easily worked. It is suitable for furniture and general purposes.

Careya arborea, Gaertn., Kahata. This is a common tree, flourishing well at a great elevation on hill sides; it is plentiful, and yields a close-grained wood of a reddish colour, hard, heavy, strong, and suitable for house-building, wheelwrights' work and furniture.

Cassia siamea, Lam., Wa. A tree of large dimensions, yielding timber of a brownish colour, close-grained, hard, and of moderate weight. It takes a good polish, and is suitable for furniture, carpentry and general purposes.

Chloroxylon Swietenia, DC., Buruta, Satinwood. This is a large tree, yielding logs 20 feet in length by 2 feet in diameter. The wood is of a yellowish or straw colour, close-grained, hard, and heavy, takes a good polish, and is an excellent furniture wood. It is also suitable for any fancy or ornamental purpose.

Dialium ovoideum, Thw., Gal-siyambala. A tree of large dimensions,

yielding timber of a dark colour, with a fine close grain, hard, of moderate weight, takes a good polish, and will make good furniture.

Diospyros ebenum, Koen., Kaluwara. Ebony. This tree is common in the mountain forests, and yields a jet-black wood, close in grain, hard, heavy, difficult to work, taking a high polish. It is suitable for furniture, ornamental fancy work, turnery, &c. There is a heavy amount of sap-wood on these trees.

Diospyros quæsita, Thw., Kalu-médiriya. This is the famous Calamander wood so much prized for its beautiful shades, alternating from cream to chocolate and black, in the colour of the heartwood. The best and most valuable is produced by trees growing on dry, rocky ground. On a rich soil the wood is generally of a plainer character. It is very suitable for cabinet-work. Trees yielding this wood are said to be getting scarce.

Eugenia Jambolana, Lam., Maha-dan. The wood of this tree is much used for house-building and for agricultural implements. It is also suitable for furniture.

Grewia tiliæfolia, Vehl., Daminiya. This is a tree of large size, flourishing best upon the mountain sides. It yields wood rather soft, of a pinkish colour, flexible and light. It is easy to work, and suitable for carriage-work, house-building, and general purposes.

Holarrhena mitis, R. Br., Kiriwalla. This tree yields wood of a light colour; it has a fine close grain, is moderate in weight, and is suitable for cabinet-work.

Melia composita, Willd., Lunu-midella. A large tree, yielding a light wood, suitable for indoor-work. It is said to resist the white ants.

Mesua ferrea, Linn., Na-Gaha. The Ironwood of Ceylon. The wood of this tree is dark in colour, straight in grain, hard, heavy, and difficult to work. It is suitable for engineering purposes and any work requiring strength in timber material.

Michelia Champaca, Linn., Sapu. A large tree, yielding timber of a brownish colour, close-grained, hard, of moderate weight, taking a good polish, and suitable for furniture.

Mimusops Elengi, Linn., Munamal. The exhibits showed that this timber is disposed to be shaky at the centre, but it is an ornamental tree, and yields a heavy close-grained wood, reddish in colour, takes a good polish, and is suitable for furniture.

Mimusops hexandra, Roxb., Palu. This tree is of large dimensions, yielding timber of a reddish-brown colour, hard, and very heavy. It is used for bridges, architectural work, and general purposes.

Pericopsis Mooniana, Thw., Nédun. This is a large tree, yielding timber of a highly ornamental character, brownish in colour, striped or veined in the grain, of close texture, moderately hard, takes a good polish, and would make excellent furniture.

Schleichera trijuga, Willd., Kon. The Ceylon Oak. The wood of this tree is reddish in colour, very hard and heavy. It is used for building and a variety of purposes.

Tamarindus indica, Linn., Siyambala. A tree of large dimensions, yielding timber of a variegated grain, especially in old trees; it then resembles the Calamander timber, and makes excellent furniture.

Terminalia glabra, Wight & Arn., Kumbuk or Coobook. This

appears to be of good quality; it is dark in colour, hard and heavy. A log in the round state was lying just outside the Court.

Thespesia populnea, Corr., Suriya. A famous avenue tree; its wood is said to be one of the best for carriage-building in Colombo.

Ceylon has probably sufficient timber for its local wants; in its furniture woods there may even be some to spare to meet any moderate demands.

MAURITIUS.

The Timber Exhibits of this Court were from the Botanical Gardens, and consisted of a collection of woods, seventy in number. These were thin pieces of board, and varied in size from about 4 to 12 inches in the length and breadth. There were also a few thin cross-sections, varying from about 5 to 12 inches in diameter, with the numbers cut into them, all fixed to the walls of the Court. An inspection of these specimens showed that there were apparently some timbers of good quality included among them, which possibly would prove suitable for constructive and furniture purposes. Judging from the appearance of the exhibits, the following are about the best in quality, viz.: Bois d'ébène, Bois cannelle, Bois sandal, Makak, Sang dragon, and Sissoo. These would be furniture woods; there are, however, some others nearly equal to them in value.

A brief description of some of the best is appended.

Adenanthera pavonina, Linn., native name Bois noir. This is a large tree, yielding timber of a beautiful red colour, with darker shades alternating. It is close in grain, hard, has a fragrant smell, takes a good polish, and resembles Rosewood. It is suitable for cabinet-making and for many other purposes.

Artocarpus integrifolia, Linn., Jacquier. A large tree, yielding timber of a brownish colour, and of excellent quality, suitable for furniture.

Camphora officinalis, Nees, Camphrier. A large tree, from which stout scantlings suitable for constructive purposes can be obtained.

Canarium Colophania, Baker, Bois Colophane. A splendid tree, attaining large dimensions. Canoes are frequently made of it. Its wood is suitable for many purposes.

Calyphyllum inophyllum, Linn., Tatamaca blanc. A large tree, yielding timber of a twisted or curly grain, very tough and strong, suitable generally for constructive and wheelwrights' purposes.

Dalbergia Sissoo, Roxb., Sissoo. This Indian tree is of considerable size, and yields timber of a greyish-brown colour, with darker veins towards the centre. It is light in weight, but strong, takes a good polish, and is suitable for furniture, ship- and house-building.

Diospyros ebenum, Bois d'ébène. This is a medium-sized tree, yielding timber of a brown colour, changing to nearly black in seasoning; it is close-grained, hard, and very heavy, takes a good polish, and is suitable for inlaying furniture, and for fancy or ornamental purposes.

Heritiera littoralis, Ait., Bois de table. A large tree, yielding timber of good quality, suitable for house-building and general purposes.

Labourdonnaisia calophylloides, Boj., Bois de natte à petites feuilles. Of this there are several varieties, all large trees, yielding timber of a dark colour, close in grain, moderately hard and heavy. It takes an excellent polish, and is suitable for ship- and house-building, also for cabinet-makers' purposes.

Lagerstræmia Flos-reginæ, Retz., Goyavier fleur arbre. A large tree from India, yielding timber of a hard, tough nature, suitable for constructive purposes, wheelwrights' work, &c.

Mespilodaphne cupularis, Meisn., Bois de cannelle. This is a medium-sized tree, yielding a dark-coloured wood, close in grain, of a quality suitable for and much prized by cabinet-makers.

Mimusops erythroxylon, Boj., Makak. A large tree, yielding timber of a dark colour, close in grain, hard and heavy. It takes a good polish, and is suitable for cabinet-making, ship- and house-building.

Noronhia Broomeana, Horne, Bois sandal. This is a large tree, yielding wood of a fragrant character; it takes a fine polish, and is suitable for the cabinet-maker, turner, wheelwright, and carpenter.

Pterocarpus indicus, Willd., Sang dragon. This is also a large tree, yielding a rich red-coloured timber, close-grained, hard, strong, suitable for furniture, wheelwrights' work, and house-building.

Sideroxylon Bojerianum, A. DC., Tambalacoque, and *S. Boutonianum*, A. DC., Mangier. Large trees, plentiful, yielding hard, strong timber, suitable for house-building and general purposes.

Stadtmannia Sideroxylon, DC., Bois de fer. A medium-sized tree, yielding timber of a hard, strong character, suitable for house-building and general purposes.

Terminalia Benzoin, Linn. f., and *T. Catappa*, Linn. There are three varieties, two being known as Benzoin and Badamier. They are large trees, yielding hard, heavy, strong wood, suitable for wheelwrights' work and house-building.

Seychelles.

The Timber Exhibits in this section of the Mauritius Court were by Charles Dupuy, thirty-four in number, all neatly and uniformly prepared, about 1½ inches by 2½ inches by 2 feet in length; these were secured to the wall, and spread out fan-like, high up, and far beyond reach, so that the names could not be seen. In the Catalogue the names of a few agreed with those of woods in the Mauritius; there are some others, as Bois de pomme, Bois d'oranger, &c., that seem to indicate that they are generally small trees of no great commercial value. As there is no information, however, to be found in the Catalogue in regard to them, it necessarily follows they should be passed by as being for local use only.

Mauritius has apparently more than sufficient timber for its own uses, and could spare to a considerable extent some of its surplus varieties, for furniture and building operations.

STRAITS SETTLEMENTS.

The Timber Exhibits in this Court were trunks of trees, sections, &c. The Forest Department exhibits specimens of wood, fifty-six in number; Dr. T. I. Rowell, specimens of Straits timber, 114 in number; Chi Bun Hong, specimens of timber, fifty-two in number; the Government of the State of Sungai Ujong, ornamental and other woods, twenty in number; and the Government of Perak, woods, forty-five in number—there being, as per Catalogue, a total of 287. Further, there are from Sĕlângor, a collection of timber from the jungles, and some specimens of timber with scientific notes shown by Mr. H. E. Newton. These exhibits consist for the most part of small pieces, half-sections varying from 12 to 15 inches in length, stems of small trees and shrubs, some short cross-sections the full growth of moderate-sized trees, upon which, unfortunately, the labels were in many cases damaged, and the names not legible. There were also some prepared specimens about 1 inch by 4 inches by 6 inches, and Mr. H. E. Newton's specimens 1½ inches by 1½ inches by 3 feet of woods in ordinary use in the Straits Settlement, which he had tested experimentally for transverse strength.

These several lots were set out in six parcels, but after looking into them, over and over again, Catalogue in hand, it was found impossible to identify more than a few of the woods. Upon one occasion the Assistant Executive Commissioner joined in the effort, anxious to help, but after working for some time without making satisfactory progress, he came to the conclusion that errors must have occurred in packing the exhibits for shipment.

The following are the woods made out from the parcel shown by the Forest Department:—

Dyera costulata, Hook. f., native name Jĕlûtong; *Eugenia zeylanica*, Roxb., Kĕlat; *Fagræa*, Nipis Kûlit; *Litsæa*, Kandis; *Litsæa*, Sapah Pĕtei; *Shorea*, Dûrian Daun; *Terminalia*, Kerâlei; *Tetranthera*, Mĕdang Tĕlor and Nyâtoh. Several of these appeared good in quality, and doubtless would be useful for many purposes.

The "Notes on the Straits Settlements" make no mention of timber as an article of produce; it seems therefore likely that the Colony is dependent, for many of the woods in use there, upon supplies from Borneo and Australia.

The following are a few of the principal woods referred to in Mr. H. E. Newton's notes:—

Afzelia palembanica, Baker, native name Miraboo. A large tree, plentiful, yielding timber of a close fine grain, hard, tough, rigid, taking a good polish, and suitable for furniture.

Apodytes, Darroo. A moderate-sized tree, yielding timber of a straw colour, having a peculiar aromatic smell; it is easy to work, and suitable for carpentry purposes.

Artocarpus, Kladang. Also a tree of moderate dimensions, yields a light yellowish-brown coloured timber, close-grained, moderately hard, flexible, takes a fine polish, suitable for furniture and ship-building.

Calophyllum inophyllum, Linn., Bintangore or Poon, is of moderate size, and yields timber of a reddish colour, coarse-grained, and moderately

hard; small mast and spars are made of this wood for prahus and junks. It is also suitable for carpentry.

Canarium, Damar Laut., is a large tree, plentiful, yielding timber of a brown colour, close-grained, and very strong; large scantlings for constructive purposes can be obtained from it.

Dialium indum, Linn., Krangie. A large tree, yielding timber of a dark colour, finely veined, hard, and suitable for furniture and building purposes.

Hopea, Seriah. A medium-sized tree, yielding timber of a reddish colour, close in grain, moderately hard, suitable for carpentry and general purposes.

Sloetia Sideroxylon, Teysm. & Binn., Tampinnis, is a moderate-sized tree, yielding wood of a brown colour, close-grained, moderately hard, it takes a good polish, resembles Mahogany, and is suitable for furniture and civil architecture.

Vatica Rassak, Blume, Rassak. A tree of large size, yielding timber of a dark colour, close-grained, moderately hard, suitable for bridges, piles, carpentry, &c.

The following have native names only :—

Ballow. A large tree, attaining a height of 60 to 100 feet, and 4 to 6 feet diameter. It yields timber of a brownish colour, close-grained, hard, and heavy, very suitable for architecture, and for most purposes where strength is required.

Billian. A tree of large dimensions, yielding timber of a brown or drab colour, close-grained, very hard, and difficult to work. It is sometimes called Ironwood, and is suitable for bridges and piles, or any purpose in carpentry where great strength is required.

Damar Putih. A large tree, yielding timber of a brown colour, close in grain, hard and heavy, it resists sea-worms, and is suitable for piles or bridges.

Tambaga. A tree attaining 100 to 150 feet in height and 3 to 5 feet diameter. It yields a strong, rigid wood, suitable for the stoutest scantlings required in either engineering or architecture.

HONG KONG.

The Timber Exhibits of this Court, sent by Mr. C. Ford, Superintendent of the Public Gardens, were arranged in five tiers, and set up in a case or frame against the wall. They were eighty-six in number, the dimensions being about 10 inches in length, by a third part segment of trees, varying from 6 to 10 inches diameter. It is therefore assumed that the trees of the Colony are all small.

Judging from the appearance of the specimens, *Artocarpus*, *Sarcocephalus*, *Spondias*, and *Vitex* are probably the best in quality, and suitable for furniture; some others might be employed for general purposes, while a few would be of little value.

The timber exhibits, having regard to the growth of trees in the Colony,

were appropriate, and suited to the purpose; but there is no evidence of there being a good supply or even sufficiency for local wants, consequently there can be none to spare for export. Hong Kong is clearly dependent for most of the woods in use there upon foreign supplies.

BRITISH NORTH BORNEO.

The Timber Exhibits in this Court were sent by the British North Borneo Company, in neatly prepared specimens, about 12 inches in length, in small segments taken from short cross-sections of trees, and in broad planks or flitches, each piece having a polished face. These were all well placed for inspection, and collectively made a good display, giving the impression that the Colony in its forests has a variety of trees yielding timber suitable for constructive works, or for ornamental and furniture purposes, notably the Billian, Kayu-Kapor, Krewing, Mirabou, and Panagah.

A brief descriptive account of these and a few others is appended:—

Exhibits Botanically Named.

Afzelia palembanica, Baker, native name Mirabou. A tree of large dimensions, plentiful, yielding a dark-coloured, close-grained wood, tough, strong, and taking a fine polish; is suitable for cabinet-making. A fine flitch of this timber suggested that it would be a good substitute for Spanish Mahogany.

Vatica Rassak, Blume, Rassak. A tree of large dimensions, plentiful, yielding timber of a yellowish colour, coarse-grained, hard, heavy, and suitable for carpentry and wheelwrights' purposes. There are two other varieties of Rassak of smaller dimensions, but these are not plentiful.

Dryobalanops aromatica, Gaertn. f., Kayu-Kapor. A tree of large dimensions, yielding timber of a yellow colour, moderately hard, and not heavy. As this gives good lengths for planking in ship-building, it would also be suitable for engineering and general purposes.

Exhibits not Botanically Named.

Billian or Ironwood. A tree of considerable dimensions, plentiful, growing in moist situations on the banks of rivers. The timber is of a reddish colour, moderately hard, heavy, and is said to be Teredo proof; being so, it would be suitable for piles and planks in ship-building, &c. A broad flitch of this timber which was exhibited admirably illustrated its good quality.

Ballow is similar to Billian in dimensions. It is of light-brown colour, close-grained, moderately hard, and might be applied to the same purposes.

Gagil. A tall tree of medium dimensions, plentiful, yielding a light-coloured timber, easily worked; this would be suitable for ship-building, masts, spars, and general carpentry. It is said the white ants will not touch it.

Greeting. This is a tall tree, plentiful, and yielding timber of a yellowish colour, with darker shades at centre. It would be suitable for engineering purposes and furniture.

Krewing [? *Melanorhœa glabra*, Wall.]. There are three kinds of this, all yielding timber of a brownish colour, easily worked; they take a fine polish, and are suitable for the cabinet-maker and general use in the domestic arts.

Kumpas. A large tree, plentiful, yielding timber of a dark-brown colour; it is a little open-grained, hard, but not heavy, very suitable for carpentry and general purposes.

Laman-Laman, Maraka, and Niatu are furniture woods.

Palawan is a tree of moderate size, plentiful, yielding timber of a reddish colour, fine-grained, hard, splits easily, makes good shingles, and is suitable for all kinds of carpentry and wheelwrights' work.

Panagah. A tree of medium dimensions, yielding timber of a dark colour, with some figure in the grain. It takes a good polish, would make veneers, and would be suitable generally for the cabinet-maker or for turnery.

Rusgass is a reddish-coloured wood, shaded or striped in the centre, and is a good furniture wood.

Selangan, Seriah, Majow, or Borneo Cedar. These trees are generally tall, and yield wood that resembles the cedar of commerce. It is very light in weight, and takes a good polish. It is found in three colours, the red being considered the best. Samples of the red, yellow and white, were sent for exhibition. The wood of these trees is in use for house-building and for furniture.

Siroyah. A light wood which would be useful for the same purposes as Selangan.

Urat-Mata. A large tree, yielding timber of a yellowish colour, close in grain, slightly wavy or figured, and strong; this would be useful for engineering, architectural, and cabinet-makers' purposes.

The timber trees of this Colony were well represented in its exhibits to the extent of about a score in number; it appears, however, that there are at least seventy known varieties, existing in great abundance in British North Borneo, many being very valuable. Hence, as the facilities for working the forests from the sea-board are good, supplies might easily be drawn from this source to meet any home wants for furniture or other purposes.

BRITISH GUIANA.

The Timber Exhibits in this Court were under the charge of Mr. G. H. Hawtayne, C.M.G., Administrator-General of the Colony, and consisted of planks about 2 feet in length, by the full breadth of the trees from which they were taken—in number about 100; and by Messrs. Park and Cunningham, who showed a collection of cabinet-making woods, prepared to an uniform size of about $3\frac{1}{2}$ inches by 15 inches in length—these being duplicates of the same description of timber as was shown in the parcel of 100 above mentioned.

The whole of these exhibits were set out and conveniently placed upon shelves for inspection, where they made by their variety of shade and colour an attractive display; hence it took only a short time to be satisfied that there are among the forest trees of British Guiana many that would yield, not only timber for works of construction, but also a choice assortment of an ornamental character, suitable for furniture.

It is scarcely necessary to prominently notice individually any of the woods referred to, where there are so many of high character; they will be best treated of in the brief descriptive account which is here appended:—

Woods Botanically Named.

Achras mammosa, Bonpl., native name Bartaballi. This tree flourishes best on clay and sandy soils; it attains to considerable size, and yields timber of a pale-brown or yellow colour, is close-grained, moderately hard, will float when seasoned, and is suitable for architecture and furniture purposes.

Brosimum Aubletii, Poepp. & Endl., the Letter-wood tree, and the Tibicusi tree. They have the same properties of usefulness, and attain moderate dimensions, but yield, on account of excess of sapwood, only a small diameter of duramen or heartwood; this is valuable, however, as it is beautifully marked, and close in the grain, is hard, heavy, takes a good polish, and is suitable for cabinet-work, walking sticks, &c.

Carapa guianensis, Aubl., the Caraba or Crabwood tree. There are two kinds of this, the white and red; both are tall trees, and attain a large size: they are regarded as very useful woods for architecture, for furniture, and being of moderate weight, they are often made into masts and spars for shipping.

Caryocar tomentosum, Willd., the Souari trees. These thrive best on a stiff clay soil on the hill sides, they are plentiful, and attain large dimensions, yielding timber of a cross-grained, yellowish colour, hard, heavy, tough, and suitable for engineering and ship-building purposes.

Copaifera pubiflora, Benth., and *C. bracteata*, Benth., the Kooroboorelli, or Purple-Heart tree. One of the tallest trees of the Colony, overtopping nearly all others. It attains a very large size, and yields timber of a purple colour, hard, close-grained, very tough and strong; its weight is moderate. This wood is suitable for mill cogs, engineering, carpentry, and furniture purposes.

Dimorphandra Mora, Benth. & Hook. f. (*Mora excelsa*, Benth.), Mora. There are three varieties of this known as Red, White, and Morabucquia. The two first grow in swamps or damp situations; they are all considered durable woods, attaining moderate dimensions, and yielding timber of a reddish-brown colour, twisted in the grain, and difficult to cleave; it is very tough and strong, takes a good polish, and is fit for furniture and ship-building. A fine log of Mora stood erect in the middle of the British Guiana Court. Mora is classed among the best woods at Lloyd's.

Dipterix odorata, Willd., the Kumara or Tonkin Bean tree. Of moderate dimensions, and yielding timber of a brown colour, close-grained, heavy, and exceedingly tough, it is suitable for cogs, shafts, and most

purposes in carpentry. The Tonkin Beans, or fruit of this tree, are used by the Indians to perfume their hair-oil.

Eperua falcata, Aubl., Wallaba. There are four varieties of this tree, locally known as Bimiti, Itoori, Kara-bimiti, and Sare-bebe; they are all plentiful, and of moderate size—the two last are inferior in quality, but the others yield good wood for staves and general purposes.

Humirium floribundum, Mart., Bastard Bullet tree. This tree is plentiful, attains medium dimensions, and yields wood of a dark colour, moderately hard, strong, and suitable for carpentry and many other purposes.

Hymenæa Courbaril, Linn., Simiri or Locust. A moderate-sized tree, yielding wood of a yellowish-brown colour, streaked, close-grained, hard and heavy. It takes a good polish, and is suitable for cabinet-work; it also makes good tree-nails for fastening planks on ships.

Ixora triflorum, Benth. & Hook f., Hackia. A tree of medium dimensions, yielding a dark-brown, close-grained, hard, heavy wood, that takes a good polish, and is suitable for cogs, shafts, and cabinet-work.

Lecythis grandiflora, Aubl., and *L. ollaria*, Linn., Wadaduri or Monkey Pot, and Kakaralli trees. There are two of this class, both attaining large dimensions: the wood of the former is red in colour, hard, and of good quality; the wood of the latter is light brown in colour, close-grained and tough—both being suitable for building and furniture purposes.

Machærium Schomburgkii, Benth., Itikiboura-Balli. Is a tree of moderate size, yielding wood of a dark brown or blackish colour, close-grained, hard and strong. It would take a fine polish, and be suitable for furniture.

Mimusops globosa, Gaertn., the Bullet tree, attains a very large size, and yields timber of a dark-reddish colour, close-grained and solid. It is suitable for all kinds of millwrights', engineering, and architectural work requiring large, strong scantlings.

Nectandra Rodiæi, Schomb., the Greenheart tree. It is said there are three varieties of this—the Yellow, Black, and Mainop; they grow to tall trees in clay soil, and when near the rivers and creeks, attain large dimensions, yielding timber of a yellowish-brown colour, close in grain, very hard and heavy, the black variety being the heaviest. Greenheart is among the first-class woods at Lloyd's, and is an admirable timber for ship-building, engineering work, and for any purpose where great strength in scantlings is required. A fine log of Greenheart stood erect in the middle of the Court.

Omphalobium Lamberti, DC., Hiawa-Balli. This is a moderate-sized tree, yielding wood of a reddish-brown colour, hard, and of great beauty. It is in request for cabinet-work, and would be suitable for most fancy and ornamental purposes.

Oreodaphne, Brown Cirouaballi and Yakooro Cirouballi. Trees of moderate dimensions, yielding dark-brown coloured woods, hard, strong, and suitable for ship-building. A fine log of Cirouballi stood erect in the middle of the Court.

Simarouba officinalis, DC., Simarupa. A tree of large size, yielding timber of a yellowish colour, close-grained, easy to work, and one of the lightest woods of the Colony. It is plentiful, and should be in request for local building and general purposes.

Vochy guianensis, Aubl., Eta-Balli. A tree of moderate dimensions,

yielding wood of a yellow colour, hard, and fairly strong. It would take a good polish, and be suitable for furniture and many other purposes.

WOODS NOT BOTANICALLY NAMED.

Aramata. This tree is common throughout the Colony, it attains medium dimensions, yields a dark, hard wood of moderate weight, suitable for carpentry, ship-building, and cabinet-work.

Arrisouroo [*Vatairia guianensis*, Aubl.]. This tree flourishes best in moist situations near to rivers; it attains medium dimensions, has a yellowish-coloured wood, close-grained, of moderate hardness and weight. It has a bitter taste, and is not eaten by worms. It would be suitable for piles, wharfs, ship- and house-building.

Assakoola. A tree of moderate dimensions, yielding wood of a reddish colour, hard, heavy, and taking a good polish, it would make veneers, and be suitable generally to the cabinet-maker.

Assapaka. Also a tree of medium size, yielding a light-brown coloured wood, moderately hard. It takes a good polish; and is suitable for cabinet purposes.

Dakama-Balli and Dukala-Balli are large trees, yielding timber of a reddish colour, close-grained, rather heavy, but capable of taking a fine polish; builders and cabinet-makers will find these useful.

Determa. This tree attains a very large size, and yields timber resembling Cedar; being light in weight, it is valuable for boat- and carriage-building, as also for masts and spars of vessels.

Dukuria. A tree of moderate size and plentiful, yielding a dark-coloured wood, close in grain, hard and heavy, quite suitable for carpentry and many local purposes.

Eueriballi and Houboo-Balli are trees of medium dimensions, yielding wood of a dark colour, hard, of moderate weight, and very suitable for cabinet-makers' work.

Foglekop [Bird's Head]. A tree of moderate dimensions, yielding a light-coloured, close-grained wood, not heavy; being plentiful, this should be in request for carpentry generally.

Hoorihea and Hoorowassa are trees of medium size; they yield wood of a brown colour, close in grain, hard, and suitable for house-building, wheelwrights' work, and general purposes.

Kabukalli is a very large tree, one of the tallest of the forest. It yields scantlings equal to the stoutest required for engineering purposes, is good for ship- and boat-building, and is considered very little inferior to Mora. In working the Kabukalli has an unpleasant smell, which is disliked by worms.

Kanooka-Balli and Kanooka. Trees of moderate size, yielding dark-veined woods, close-grained, hard, heavy and strong, suitable for furniture.

Kauta-Balli [*Hirtella americana*, Linn.], Kookeritte-Balli, and Koola-Balli. Trees of medium size, yielding timber of a dark colour, close in grain, hard, but not difficult to work. They will be of considerable value for carpentry and wheel-wrights' work.

Keritee. Also a tree of medium size, yielding timber of a light colour. It has a strong aromatic scent, and would take a fine polish. In appearance it resembles Satinwood, and can be used for similar purposes, also for boat-building and carpentry.

Koorikye and Kurahara (which somewhat resembles Cedar). Trees of medium dimensions, yielding timber of a reddish-brown colour. They work up well, take a good polish, and are fit for furniture, and for masts and spars of small vessels.

Lallifer. A tree of moderate size, yielding timber of a yellowish colour, hard, close-grained, with a strong aromatic scent. It is difficult to procure it of a large size, free from holes, but otherwise it appears good in quality. It is used for boat-building and general purposes.

Mamoori-Balli, Maniballi, Marciballi, and Moora-Balli. All trees of medium size, differing very little from each other, yielding timber of a brownish-yellow colour, moderately hard, strong and tough, very suitable for house-building or other work, if not exposed to the weather. Young trees of the third-named are considered equal in quality to Greenheart timber.

Pakoorie. This tree thrives in loose sandy soil, and near to rivers and creeks. It attains only moderate height, but its stem is large in comparison, and will often yield thirty-six inches clear of sap. The wood is of a dark colour, hard, strong, and suitable for house-building and wheelwrights' work.

Siki Siki Danna. The wood of this tree is dark and heavy. It is known as Ironwood, and for many purposes, where strong scantlings are required, it will be of considerable value.

Suradanni attains a large size, has a red-coloured wood, moderately hard, that is suitable for ship- and boat-building, and many purposes. A fine log of Suradanni stood erect in the middle of the British Guiana Court.

Tataboo. A large tree, yielding a dark-coloured, striped or shaded wood, hard and heavy, suitable for millwrights, carpentry, and ship-building.

Washiba or Bow-wood tree. This attains a large size, and yields timber of an olive colour, it is very hard, tough, and close-grained. It is the best known wood for bows, and, as it takes a good polish, it is suitable for cabinet-making.

Waibaima. This tree is considered to be of the Greenheart class; it attains a large size, yields timber of a dark colour, having a strong aromatic scent and bitter taste. In the Colony it is much used for planking vessels, and for all purposes in ship-building where Greenheart is used. Its quality appeared good.

Wamara. This is of medium dimensions, the duramen or heart-wood being close-grained, figury, hard, heavy, and having some resemblance to Ebony. The natives make their clubs of it. It is good for veneers and cabinet-work of most kinds.

Messrs. Park and Cunningham's collection of cabinet-making woods was neatly prepared, and being polished upon one face, admirably brought out the rich colour and brightness of the choicest of the British Guiana woods. It also contained others which, though of less lustre, were still valuable as furniture woods or for more general purposes.

The Mora prepared railway sleepers were good specimens, and well suited for the purpose.

The Timber of this Colony was well represented in the Exhibition; and, as shown in the foregoing report, it will be seen that there is quite a mine of wealth in the Forests of that country, for everywhere there

appears to be an abundance of valuable timber trees. From this source of supply, should a demand arise for any of these woods, it can readily be met; and if a stimulus were thus given to trade, British Guiana would be a prosperous Colony.

WEST INDIES.

JAMAICA.

The Timber Exhibits of this Court were by M. H. and T. A. Foster, Bogue, seven in number, various. Scharschmidt, Red Muskwood. Botanical Department, twenty in number, various; also woods in polished sections with natural bark, nineteen in number. Rev. J. S. Roberts, Tacca and Ironwood saplings; George and Branday, Pimento; C. W. Trealeaven, Bogue, woods in polished slabs, twenty-nine in number; Turnbull and Mudon, Kingston, twelve in number, various; A. A. Green, Balacklava, fifteen in number, various; Alfred Pawsey, Kingston, woods in trimmed and polished blocks, twelve in number. The Boys' Reformatory, fourteen in number, various. Ernest C. Elliott Vere, woods in polished slabs from the parish of Clarendon, 133 in number; J. M. Farquharson, Elein, three in number; and Major J. Simpson Carson, Logwood; making a grand total of 258.

It was found upon inspection of the Timber Exhibits, and by reference to the Catalogue, that many were in duplicate, triplicate, &c. They were not generally well set out for examination; at least forty were placed at the back of a counter, where they were partially screened by bottle exhibits, so that only a few of the names could be read. By a diligent search throughout, the following were met with, viz.: Birch, Cashew, Cedar, Dago, Ebony, Guava, Lance Bark, Logwood, Pear-tree, Red Blue Heart, Yacca, and a few others, but it was not possible to identify many of them by means of the Catalogue.

There is no information in the Catalogue as to the "habitats" of any of the trees, but the inspection sufficed to show that in the parcels taken collectively there were many choice, close-grained, solid woods, that would be suitable for knobs, buttons, &c., although it could not be seen with certainty that if an order were given for a plank 3 inches by 9 inches by 12 feet, any one of the trees were of a size that would yield it.

TRINIDAD.

The Timber Exhibits of this Court were by S. Devenish, 235 in number; O. Harley, Superintendent of Prisons, thirty-one in number; H. Prestoe, Botanic Gardens, specimens of polished woods; and R. Tanner, specimens of native woods, ten in number: making a total of at least 276.

The former parcel is tabulated in the Catalogue, but there is no information as to the "habitats" of the trees, or whether any are plentiful. The exhibits were thin narrow pieces about 10 to 12 inches in length, polished, and spread round the front edge of a counter. There were also

pieces a trifle longer secured vertically beneath it, and a few broad planks set up at the boundary of the Court. Most of these were identified by the Catalogue numbers, and they seemed to include all the small trees and shrubs of the island.

The following woods are worthy of special notice, as being apparently suitable for furniture purposes, viz.: Ballata, Black Cypress, Bois Lezard, Chairwood, Cordia, Lignum Vitæ, Locust, Mahoe, Mahogany, Mora, Pimento, Roble, and Yoke. The majority, however, owing to the small size of the trees, seem of very little importance. Hence it follows that, judging by the specimens and the Catalogue, Trinidad has few woods to spare in any appreciable quantity.

Barbados.

The Timber Exhibits of this Court were by the Committee, and consisted of planks, eighteen in number. They were placed upright under the boundary rail, and were partially hidden from view by casks and ornamental shrubs. Only the following could be seen, viz.: Almond, Ebony, Fiddle-wood, Fig-tree, Fustic, Inga, Locust, Mahogany, and Tamarind. Most of these appeared suitable for furniture purposes. No information is given in the Catalogue as to whether any of these woods are abundant, and probably there is little to spare for exportation.

Grenada.

The Timber Exhibits of this Court were by the Committee, and consisted of small segments of cross sections, taken from trees varying from 5 to 10 inches in diameter, 125 in number. They were piled in four tiers, trophy style. No names were given in the Catalogue, but on the exhibits were found the following, viz.: Bois Cassava, Cashew-nut, Dog-wood, Galaba, Lauriet-zabella, Red Zammier, Sapodilla, Sceiti, Tappana, and Zamboza. It is not possible to judge of the merits or value of any of these woods, but doubtless most of them could be turned to account commercially if a demand for any should arise.

St. Vincent.

The Timber Exhibits in this Court were by D. C. Mackie, Owia, forty-one in number; P. Foster Huggins, Golden Vale, forty in number; J. G. Manton, Kingston, slab of polished mahogany; E. H. Musson, Kingston, slab of polished Manchinel: altogether, eighty-three in number.

The exhibits here were chiefly in short cross sections of trees, with a groove about three inches deep cut V-shaped into them, to show the grain; thin narrow boards, and a slab of Mahogany.

Reference to the Catalogue shows that in the two heavy parcels above mentioned, fully twenty were in duplicate. It is difficult to judge by the names of these woods what they are; but a great many of them seem to have been taken from small trees and shrubs of little value commercially.

The following were met with in searching through the Court: Bayleaf, Calabash, Mastic, Fiddle-wood, Water-wood, and Cazon, the three last being in boards of good quality, but plain in character. No timber could be seen in the St. Vincent Exhibits likely to be of value for export.

Tobago.

The Timber Exhibits in this Court were by J. G. McCall, native hard-wood; A. Gray, cabinet-maker's wood; Hon. E. Keens, woods for building purposes, mill and cart work, tool-makers, and boat-building.

The specimens were in thin pieces, about 3 inches wide and 12 inches in length, secured upright under a counter top; as the names of these were upon the edge, they could not easily be read. There were also a few half and some whole short cross sections of trees upon the floor. No names were given in the Catalogue; and under these circumstances, with nothing specially attractive in timber to be seen, it may be considered that Tobago at present has none for export.

St. Lucia.

The Timber Exhibits in this Court were by the Agricultural Society, forty-one in number.

They were chiefly in boards of about 3 feet in length, varying from 8 to 12 inches in width, and set up vertically about seven feet above a counter covered with various exhibits; another smaller parcel was placed over a glass case rather higher up, both being out of reach, so that it was not possible to read the names. From some short cross sections better placed were read the names of Bois Cassava, Dibasse, Satinwood, and Savonette. All the woods appeared good in quality; and of the former parcel several had a nice colour, that might be taken as suitable for furniture purposes.

As no information is given in the Catalogue as to whether any of the trees grow to a marketable size or are plentiful, probably there are none to spare for export.

Antigua.

The Timber Exhibits in this Court were by F. S. Cassin, Mahoe-wood; V. Guffroy, sixteen samples of woods; N. Hillhouse, Mahogany; J. Jarvis, Logwood; Julian Lake, Red Cedar, Mahogany, Logwood, Yellow Prickle; Joseph Lake, Red Cedar; and J. Sutherland, eighteen in number: making a total of forty-two.

The greater number of these were in thin pieces varying from 3 to 6 inches in breadth, and about 12 inches in length, secured to frame work against the edge of a counter top; other pieces were about 7 by 7 by 12 inches in length. Sixteen of the exhibits were without names in the Catalogue. The following were identified, viz.: Acacia, India Oak, Iron-wood, Locust, and Mastick. All these were good in quality, and suitable in appearance either for works of construction or furniture. A few others are doubtless of equal value for similar purposes. As, however, there is no account given in the Catalogue of the "habitats" of the Antigua trees, it is impossible to state with certainty the scantlings any would yield; but judging from the names, many of the exhibits seem to represent small trees of little value.

St. Christopher.

The Timber Exhibits in this Court, by C. Alexander Harris, consisted, as per Catalogue, of specimens of Lignum Vitæ. These could not with

certainty be identified. Some half and whole short cross sections were however seen at the boundary separating this from the Montserrat Court.

Dominica.

The Timber Exhibits in this Court were by Dr. H. A. Alford Nicholls, boards of native cabinet woods, and a collection of Dominica woods (polished slabs); J. A. Garraway, Annatto Logwood; Alex. Johnson, Satinwood, Bullet-wood, Razor Strop; and A. M. Meltz, Mawbie-wood.

Four board exhibits were set dado fashion against the wall of the Court; as also, in two tiers, specimens about 1 by 3 by 12 inches in length, over a counter covered with other goods, these partially screening the Timber Exhibits. The boards by their appearance were good and handsome furniture woods, and many of the others by their richness of colour and density were certainly of good quality and suitable for the same purpose, or for works of construction. Owing, however, to the difficulty of reading the names, they were not identified with the Catalogue.

It is understood that there are in the Colony considerable forests of fine trees, such as Angelin, Balata, Bois Riviere, and many others; consequently it will be reasonable to suppose these may be drawn upon largely if required.

Montserrat.

The Timber Exhibits in this Court were, by J. S. Hollings, forty-five varieties: and by the Committee, specimens.

These exhibits were short cross sections and segments of cross sections of trees, varying from 6 to 12 inches in diameter, all being without names in the Catalogue. It is not possible under these circumstances to form an opinion as to the merits of any.

Bahamas.

The Timber Exhibits in this Court, by R. H. Sawyer and Company, consisted of Sabicu, Satinwood, Lignum Vitæ, Ebony, Brazaletto, Mahogany, Horseflesh (ships' knees), all good woods, very suitable for works of construction and furniture purposes.

There is no information in the Catalogue to show whether any of these are plentiful; but if they are, a considerable commercial value attaches to them.

It is remarkable that with the exception of Dominica there was no information to be found in the Catalogue with regard to the trees of the West Indies, of which the exhibits were intended to be the representatives; although these in number amount to 888, besides collections of woods, specimens, &c.—probably close upon 1000 in all. It cannot therefore be clearly seen what the several islands contain in timber, whether useful or otherwise.

BRITISH HONDURAS.

The Timber Exhibits in this Court were, by the Belize Estate and Produce Company, Limited, A. S. Kindred, Manager, about 103 in number; by B. Cramer and Company, Mahogany, Logwood, Ziricote, and Pitch Pine; by Franco Andueza, Logwood; Mutrie, Arthur and Currie, Logwood; J. Hutchinson, Dist. Mag, Pta. Gorda, Rosewood; J. Morais, Gorda, Palmalatto or Zebrawood; and by the Government, Mahogany slabs: taken together, about 135 in number.

Most of the Timber Exhibits were taken from small trees which seldom make good or fair specimens of the woods they are intended to represent; and being roughly prepared, they were not very attractive. Some were spread out like a capital to one of the pillars of the Court, and being high up, far beyond reach, no names could be seen upon them; from the parcel more conveniently placed many were identified with the Catalogue.

Although there were a great number of exhibits in the Court, it seems that choice and valuable woods for works of construction and furniture are not numerous; and that Cedar, Mahogany, Rosewood, Satinwood, and Santa Maria, with the dye-woods, Fustic and Campeche-wood, are the chief the Colony has to rely upon for a timber export trade. Of course the woods referred to are well known, and need no further mention here, as they will be better treated of in the brief descriptive account of the most important woods of the Colony which is here appended.

Exhibits Botanically Named.

Achras Sapota, Linn., Sapodilla. A tall tree, plentiful, yielding a dark-coloured wood, close in grain, figured, hard and heavy. It takes a fine polish, and is suitable for cabinet-making and carpentry.

Calophyllum Calaba, Jacq., Santa Maria. This is a tree of considerable dimensions, yielding timber of a yellow colour, close in grain, and moderately hard. Stout scantlings suitable for engineering and architectural works and for ship-building can be obtained from this tree.

Cedrela odorata, Linn., Cedar. This is a stout tree, yielding a light-reddish coloured wood, that is easy to work. Its properties are well known, and the wood will ever be in request for indoor work, and furniture.

Chlorophora tinctoria, Gaudich., Fustic. This is a dye-wood of a yellowish colour; it is also used for furniture.

Citharexylum melanocardium, Fiddle-wood. A tree of moderate dimensions, plentiful; yielding timber of a yellowish colour, close grained, hard, and suitable for carpentry and wheelwrights' work.

Dalbergia sp., Rosewood. This tree is somewhat dwarfish in height, and stout in the stem; plentiful; yielding timber of a reddish colour, with darker alternating shades of a figury character; it is dense and heavy, takes a good polish, and is in repute for pianoforte and cabinet-making. The Ziricote of the Colony is considered to be a species of Rosewood. The specimen exhibited was nearly black, hard, heavy, and excessively sappy. An exhibit of this species by Mr. J. Hutchinson fairly illustrated the character of this wood.

Hæmatoxylon campechianum, Linn., Logwood or Campeche-wood. A

small tree, of crooked, irregular growth, thriving well in marshy places. It is chiefly valued as a dye-wood.

Laplacea Haematoxylon, G. Don, Ironwood. This is a tree of small dimensions, yielding wood of a red colour, dense in grain, very hard and heavy, suitable for cogs in machinery, or any purpose where there is much wear and tear in working.

Myroxylon toluifera, Humb. & Bonpl., Balsam. A tree of moderate dimensions, yielding wood resembling Mahogany. The specimen exhibited indicated a disposition to be shaky; but if this is exceptional, it would be useful for furniture, &c.

Pimenta officinalis, Lindl., Allspice or Pimento. A tree of medium dimensions; plentiful; yielding wood of a dark colour—a favourite for walking-sticks; it would be suitable for furniture and other purposes if required.

Pinus cubensis, Griseb., Yellow or Pitch Pine. A tree of medium dimensions; plentiful; yielding a yellow-coloured wood, suitable generally for carpentry and local purposes.

Piscidia Erythrina, Linn., Dogwood. Also a variety known by the Indian name "Javin." Trees of moderate dimensions, both being suitable for house-building and for general purposes.

Swietenia Mahogani, Linn., Mahogany. This tree is plentiful, and attains large dimensions, yielding timber free from knots, of great length and stoutness. It is of a reddish colour, clean and straight in grain, generally plain, but occasionally possessing some figure. It is moderately hard, and easy to work. The best wood is susceptible of a high polish, which renders it of great value for cabinet-making. It is also suitable for carpentry and ship-building. A splendid log, hewn or squared, as usually imported into the London market, stood erect at the S.E. end of the Court. There were also several slabs of polished Mahogany (notably numbers 1 and 98 to 102*a*, inclusive, of the Catalogue), that fully illustrated the beauty and value of this wood for ornamental purposes.

Exhibits not Botanically Named.

Axemaster. A tree of moderate dimensions, yielding a dark wood, excessively hard, but susceptible of high polish; it would be suitable for turnery and ornamental work.

Button-wood [? *Cephalanthus*]. A dwarfish tree, found chiefly in the swamps. The wood is considered suitable for cabinet-work, turnery, and ship-building.

Blackheart. Like the last, it is of a dwarfish character, and yields wood of a yellowish-brown colour, nearly black at the centre. It is hard, takes a fine polish, and is suitable for furniture.

Chechem. Of this there are two kinds, Black and White. The trees are of fully moderate dimensions, capable of yielding scantlings for most purposes in architecture. A large amount of alburnum or sapwood appeared upon the Black specimen exhibited.

Drunken Bayman. A tree of medium dimensions; plentiful. The specimen exhibited indicated a disposition to be shaky.

Granadilla. Also a tree of moderate dimensions, yielding a finely-grained red wood, hard and strong; suitable for building purposes, and for furniture.

Lignum Vitæ [*Guiacum officinale*, Linn.]. This tree is only of medium dimensions, the heart-wood is nearly black, and the sapwood of a bright yellow colour; it is valuable for sheaves of blocks, turnery, &c. It is liable to the cup-shake defect.

My Lady. This tree attains fair dimensions, and yields timber of a yellow colour; it takes a fine polish, and is useful for carpentry and cabinet-work.

Redwood. A tree of medium size, yielding a hard durable wood for house-building, fence posts, &c.

Satinwood. This tree has a short stout stem; it is plentiful; it yields a bright yellowish-coloured wood, close in grain, hard, heavy, takes a fine polish, and is suitable chiefly for cabinet-maker's work.

It is surmised that if the woods specially brought to notice in paragraph 3, page 458, are plentiful, a good trade in them will continue.

WEST AFRICAN COLONIES.

The Timber Exhibits in this Court were, from Lagos, by G. L. Gaiser, eighteen in number; from Sierra Leone, by Charles Foresyth, two; A. B. C. Sibthorpe, eleven; Rev. J. Evans, thirteen; J. E. Dawson, one; and J. B. Wright, seventeen: altogether, sixty-two in number.

In the Lagos parcel four short pieces of board of a brown or drab colour, about 16 inches in width, without names or number, were noticed as having stood the test of seasoning, since they were prepared, without any sign of shake or warp. Trees yielding such boards as these would be suitable for furniture and for many other purposes. Some half-cross sections of trees, varying in diameter from 3 to 16 inches, stood about, but the names upon the labels were not legible.

In the Sierra Leone section, among the prepared exhibits, the following were identified, viz:—Brimstone, Camwood, Cedar, Ebony, Iron, and Oak. All these appeared to be good in quality, and fit for almost any purpose; there were some others not so good, that would only be useful locally.

In the Gambia section the exhibits mentioned in the Catalogue were not identified, and it seems probable that this was owing to some of them having been mixed with the parcels before referred to. A pile of round logs about 4 to 6 feet in length, and 8 inches in diameter, lay upon the floor; but they were not labelled. Although of a red colour, hard, strong, and heavy, they cannot be classified for usefulness.

The Oak referred to above has the appearance of the African Oak or Teak of Commerce, an excellent timber for ship-building and engineering purposes. If this can be brought out, it would be likely to meet with a ready sale in the home markets.

MALTA.

The Timber Exhibits in this Court were by Dr. G. O. Bardon, and consisted of a pile of round pieces varying from 1 to 2 feet in length, by 3 to 8 inches in diameter, fourteen in number. These were identified by the Catalogue: were sound and good in quality, but judging from the names they bear must be quite small trees or shrubs, and not likely to attain timber size.

CYPRUS.

The Timber Exhibits in this Court were by the Cyprus Committee, twelve in number; and consisted of thin cross sections of trees, varying from 9 to 18 inches in diameter. Several were without labels, others that had them were damaged, and the names were not legible. There was not sufficient wood in the specimens to judge of their merits; but looking at the names they bear in the Catalogue it seems likely that some good timber is to be found in Cyprus.

TIMBER.

No. II.

By ALLEN RANSOME.

THIS report is the outcome of a series of practical tests of Colonial timbers made at the works of my firm. The great variety of fine woods exhibited in the various sections of the Exhibition suggested to me the idea that many of them might with great advantage be introduced into this country in conjunction with, or in place of, the comparatively few foreign woods which have too long enjoyed a monopoly of the English market.

As a first step in this direction, I offered to the Executive of the Royal Commission to practically test any samples of woods which they might like to submit for the purpose, by working them up, by machinery, into the various articles for which they appeared best suited.

This offer was conveyed to the Agents General of the various Colonies, who showed their appreciation of the scheme by at once placing at my disposal samples of such woods as they considered best suited for the English market; and some weeks were spent in thoroughly testing them.

The operations carried on embraced felling and cross-cutting large trees by steam-power; sawing out, adzing, and boring railway sleepers; the conversion of wood in various ways by vertical, circular, and band saws; the manufacture of doors, straight and circular mouldings, flooring, match-boarding, panels, and framing; also the turning of spokes, axe, pick and hammer handles, and other similar articles; as well as the manufacture of casks for holding liquids.

In the following report I give the results of the trials, and my opinion as to the purposes for which each description of wood can be most advantageously employed; but I think it well to state that many valuable timbers which were sent for trial have been passed over without remark, on account of the samples being too small for practical experiments.

Of those timbers which are already well known I make no mention, the object being to consider only woods which are practically unknown in England, and so to help in opening a market for them. It is true that this report includes certain woods which have already been imported into England; because, although introduced to a small extent, they have not yet attained that popularity to which I think their special qualities should entitle them.

A serious difficulty in testing the samples was found in consequence of the majority of timbers submitted for trial being very wet; this refers more especially to the Eucalypti of Australia, which appear to have been felled hurriedly for the Exhibition, regardless of the season of the year, and shipped off at once. The same applies, in a somewhat less degree, to the hard woods of other countries. I deem it necessary to call especial attention to this, as it is certain that, however good a timber may be, it will never find its way into the English market, unless delivered in a thoroughly

seasoned condition. To ensure this I should therefore recommend those who are interested in establishing a trade with the home country, to saw up their timber into merchantable sections and season it thoroughly before exporting it.

With a view to forming some idea as to how the different timbers would be affected by seasoning, pieces of the various woods included in the schedules on pages 474 and 475 were planed to the uniform size of 18 inches by $4\frac{5}{8}$ inches by $1\frac{1}{2}$ inches; and after being carefully weighed, were submitted to the Cool Air Drying Process for 144 hours, with the results given below. It should, however, be mentioned that this experiment can hardly be regarded as complete, in consequence of some of the samples being very much more seasoned than others when placed in the drying chamber.

For seasoning the woods, the Cool Air Drying Process was selected, as being the most like natural seasoning of any of the artificial means at present known; and it is noticeable that though the test was very severe (the woods in some cases losing as much as 22 per cent. in weight) they have, with few exceptions, stood most excellently.

INDIA.*

Padouk (*Pterocarpus indicus*). This is a handsome wood. When first cut it is of a bright red colour, which fades unless the surface of the wood is polished at once. Being highly recommended for cabinet-makers' and superior joiners' work, this wood was passed through suitable machines, leaving both the planing and moulding machines with a perfect finish. It seasons well, takes a good polish, and is very free from knots, the tree often attaining a height of 60 to 70 feet without a single branch. It is abundant in the eastern and western coast forests of India, Burma, and the Andaman Islands, and is extensively used for furniture and railway-carriage building; for both of which purposes it should find a market in this country. A railway-carriage door shown at Stanley Works attracted much attention.

Black Wood or Rose Wood (*Dalbergia latifolia*). This wood is beautifully marked with veins of various shades of brown and purple. From the samples submitted, panels, straight and circular mouldings, and framing were prepared. Owing to the wood being rather cross-grained, it was found necessary to pass it through the machines at a comparatively slow feed. The tree attains a large size, being abundant in South India, Eastern Bengal, Oudh, and Central India. It is largely used for furniture, and is considered one of the most valuable Indian woods for that purpose. When better known in England, it will, no doubt, become popular with cabinet-makers, and probably be introduced with other ornamental woods for parquet flooring.

Sissoo (*Dalbergia Sissoo*). This wood is handsomely figured with red and brown veins. As in the case of the last-mentioned wood, it was passed through the planing, moulding, mortising and tenoning machines at a slow

* The trials included certain Indian woods, and the results are consequently recorded here.

feed, being somewhat cross-grained. This timber, which is found in the Sub-Himalayan forests, is extensively used for wheelwrights' work and carving, and is most highly prized by coach-builders, being strong, elastic and durable. It is not anticipated that it will be largely imported into England at present, as the tree does not grow in abundance in convenient proximity to the shipping ports; but should a demand arise, it could doubtless be cultivated.

Chugalam (*Terminalia bialata*). This is a beautifully mottled greyish-brown wood. Though rather hard, it leaves the machines with an excellent finish, and is as readily worked as English oak. It will probably command a sale for high-class joinery and cabinet work. The tree is found in Burma and the Andaman Islands, localities convenient for export.

Lagerstrœmia (*Flos-Reginæ*). This is a dark-brown wood, much resembling teak, and could probably be applied to many of the purposes for which that well-known wood is used. From the sample sent, match-boarding, straight and circular moulding, panels, and other joiners' work were prepared; the wood in all cases leaving the machines with a good finish; though, like teak, being full of siliceous particles, it dulls the cutters quickly. The tree is found in Eastern Bengal, Assam, and the southern portion of the west coast, and could be shipped from Calcutta, Chittagong, Rangoon and Madras.

CANADA.

Douglas Fir (*Pseudotsuga Douglasii*). This tree extends over a large portion of the Dominion of Canada, from the Eastern base of the Rocky Mountains to the Pacific Coast, and is found in great abundance. During the trials a door was made from the wood, straight and circular mouldings struck, and match-boarding run with a feed of 40 feet a minute, the work done being in all cases most satisfactory. The wood is well adapted for joinery, and the better quality could be employed for the purposes for which yellow pine is at present used in this country. As the latter is becoming scarcer every day, it seems probable that Douglas Fir will be largely imported into England, especially as the Canadian Pacific Railway passes through the forests in which it is found; thus rendering transportation easy. On the Pacific coast the tree often attains a height of 250 feet, with a girth of 40 feet at the base; the trunk tapering but very little.

Black Ash (*Fraxinus sambucifolia*). This ash is abundant in the swamps of Nova Scotia, New Brunswick, Quebec, and Ontario; and from the fact that it only grows on a marshy soil, is frequently called "Swamp Ash." It is tough and elastic, and has already been imported to a limited extent into England and used by agricultural implement makers and others. It is also asserted that it is often sent over as white ash; the two woods being very similar. Samples of this wood passed through the saw-frame and planing and moulding machines were found to work well. Spokes for

wheels and tight casks were also made from it; for both of these purposes the wood appears well suited. The tree is plentiful and grows to a large size, and being found near the rivers in the eastern portion of the Dominion, the cost of carriage to shipping ports is comparatively small; the wood can therefore be imported into England at a reasonable price.

Iron Wood, or American Hop-hornbeam (*Ostrya Virginica*). This is a light-coloured, heavy wood, very tough and elastic; it is used in Canada for axe-handles, hammer-shafts, and similar purposes. At the trials some hammer-handles were turned in the copying-lathe, the sample sent being too small to convert in any other way. The tree, which seldom exceeds one foot in diameter, is found throughout Canada, east of Lake Superior.

NEW SOUTH WALES.

Swamp Mahogany (*Tristania suaveolens*). This is a strong, tough, elastic, dark-coloured wood, with a straight grain. Having been probably cut at the wrong season, the small sample sent presented a very shaky appearance. When opened out, however, the centre was found to be quite sound, though very green. Boards were planed with remarkably good results, the cutters working freely and leaving an excellent surface. The wood is used in the Colony for mallets, tool-handles, cogs of wheels, posts, &c. The tree is found in the open forests of the northern coast districts, where it attains a height of 60 to 80 feet, with a diameter of 1 to 2 feet.

Blue Gum (*Eucalyptus tereticornis*). This is a light-coloured wood, strong and durable, and is considered one of the best hard woods in the Colony. The sample sent was tested on the planing and moulding machines, and in all cases the results were very satisfactory. The wood is used in the Colony for a diversity of purposes: ship and house-building, wheelwrights' work, plough-beams, railway sleepers, &c. The tree is plentiful, being found in the northern and southern coast forests. Its average height is 100 to 150 feet, with a diameter of 3 to 4 feet.

Ironbark (*Eucalyptus crebra*). A hard, tough, heavy timber found in abundance in the northern and southern coast districts, and extending a considerable distance inland. The tree attains a height of 100 to 150 feet, with a diameter of 2 to 4 feet. Spokes were turned from the sample, and boards planed, the finish of both being excellent. The wood is much used and esteemed by coach-builders and wheelwrights for shafts and spokes of wheels; it is also in demand for piles and railway sleepers.

Mountain Ash (*Eucalyptus Sieberiana*). A tough, elastic, and durable timber, suitable for wheelwrights' and coopers' work, palings, and general builders' purposes. From the specimen submitted spokes were turned, casks made, and boards planed: in all cases it proved an easy wood to work. The tree is plentiful throughout the Colony, attaining a height of 150 to 180 feet, with a diameter of 3 to 5 feet.

Forest Oak (*Casuarina torulosa*). A handsomely-figured, heavy wood. The sample sent being shaky, it was impossible to experiment much with

it. The wood planed very well however, leaving the machine with a good finish. It is used in the Colony for shingles, veneers, cabinet work, &c., and takes a good polish. The tree (which is plentiful) attains a height of 60 to 80 feet, with an average diameter of 2 feet. It is found chiefly in the open forests of the northern and southern coast districts and in the Blue Mountains, extending inland for a considerable distance.

VICTORIA.

Blackwood (*Acacia melanoxylon*). This wood is highly prized in the Colony, being close-grained, heavy, strong and flexible, beautifully marked, and richly coloured. It is much used by cabinet-makers, coach-builders and coopers, and also by railway-carriage and agricultural implement makers. Samples of both old and young trees were sent for trial. The former were made into joiners' specimens, the latter into casks. The figure of the old growth wood is very fine, and the surface left by the cutters was all that could be desired. The casks also proved a complete success. It is stated that timber from 10 to 20 years of age is the most suitable for coopers' work; and as the tree is readily propagated, the supply could be made to keep pace with the demand for this purpose. Large quantities of this timber are found in Tasmania as well as Victoria. The wood (which seasons well) has already been imported into England in small quantities, and sold at prices ranging from 2*s.* to 3*s.* per cubic foot.

White Box (*Eucalyptus hemiphloia*). This remarkably hard and tough wood is used in the Colony for railway sleepers, &c. It is found in mountainous districts, the tree attaining an average height of 60 to 70 feet, with a diameter of 2 to 4 feet. Owing to the difficulty of transport, and the fact that other timbers of equal value are more plentiful in the Colony, it is improbable that this wood will ever be exported in large quantities. During the trials a sleeper was adzed and bored, but for boring especially the wood seems very hard. A panel was also passed through the planing machine, but, owing to the sample being very cross-grained, the results were not good.

Blue Gum (*Eucalyptus globulus*). This is a hard, light-coloured timber, of great strength and tenacity. The tree grows to a colossal size both in Tasmania and Victoria. By way of testing the sample sent, a sleeper was adzed and bored, and a panel planed. Both experiments proved very satisfactory, the latter especially so, as the wood was found to plane as well against the grain as with it. Being plentiful, it is extensively used in the Colony for beams, joists, &c., in buildings, and also for railway sleepers, piers and bridges.

Red Gum (*Eucalyptus rostrata*). This is a very hard, compact wood of a brown-red colour, with a handsome but short grain. It is largely used in the Colony for fencing posts; and is especially adapted for engineering works and buildings, when required to withstand a vertical pressure; on account of its short grain, however, it is not considered trustworthy to

support a transverse strain. It has the reputation of being the best of all the gums for railway sleepers, being almost indestructible in damp soil. The sample sleeper sent for trial, though a hard specimen, was readily adzed and bored by the machine, and a plank passed through the planing machine gave fair results. The tree is abundant throughout the Colony along river flats and open valleys.

SOUTH AUSTRALIA.

Red Gum (*Eucalyptus rostrata*). This is the same wood as that last described from Victoria, and being tested in the same way, gave similar results.

Blue Gum (*Eucalyptus leucoxylon*). A light-coloured, close-grained, hard and heavy wood. A sleeper was experimented on in the adzing and boring machine with highly satisfactory results, and boards passed through the planing machine left the cutters with an excellent surface. It is used in the Colony for railway sleepers, posts, piles, and general purposes. The tree grows to a height of 100 feet, with an average diameter of 3½ feet.

Sugar Gum (*Eucalyptus corynocalyx*). This is very similar to the wood last described, and is used for much the same purposes. As in the case of the blue gum, a sleeper was worked in the adzing and boring machine, and boards were planed with like results. The tree, which is considered one of the most valuable in South Australia, attains a height of 130 feet, with a diameter of 4 to 5 feet.

QUEENSLAND.

Bean Tree (*Castanospermum Australe*). A beautifully-figured, brown wood. The sample sent, being very wet, was tried under somewhat unfavourable circumstances. A baluster was turned from it and some boards and panels planed, the work from both lathe and planing machine being excellent. This wood should prove valuable for cabinet-makers, but should be thoroughly seasoned before being used, as it shrinks very much in drying. The tree, which is common throughout the Queensland scrubs, is easily accessible, and can be conveyed by water at small expense to Brisbane and Maryborough.

Cypress Pine (*Frenela robusta*). This wood varies in colour from a light to a dark brown; it is straight-grained, durable, beautifully figured, and easy to work. It is used extensively in the Colony for cabinet-work, furniture, piles, and the sheathing of boats, as it is said to resist the teredo. The wood worked admirably under the action of the cutters, which left a perfectly smooth and glossy surface. It shrinks and warps but little in seasoning. The tree is abundant throughout the ranges of Southern Queensland, and is easily accessible.

Bunya Pine (*Araucaria Bidwilli*). This is a straight-grained, light-coloured, mild-working wood, often prettily marked, and it is much used in the Colony for cabinet-makers' and joiners' work. Judging by the experiments, it should make excellent framing, and as it planes well, could be used for common furniture, as it is not inclined to warp or twist. The tree, which grows to a large size, is found on the Bunya range, and the Condamine, Dawson, and Burnett Rivers.

Moreton Bay Pine (*Araucaria Cunninghamii*). This is a rather harder and better wood than the last mentioned. It is of a light colour, with a straight grain, and planes very smooth with a rapid feed. Locally it is extensively used for flooring and lining boards in house-building, also for cabinet-work. The tree grows near the coast in both North and South Queensland.

Forest Oak (*Casuarina torulosa*). This being the same wood as the Forest Oak of New South Wales, before mentioned, the same remarks (as regards the experiments) apply to both. The tree is plentiful in South Queensland, easily accessible, and could be shipped from Brisbane.

Pencil Cedar (*Dysoxylon Fraserianum*). This wood is of a reddish colour with a good figure. It worked excellently in the machines, and planes especially well. If it can be imported at a reasonable price, it might take the place of mahogany. It is chiefly used in the Colony for cabinet-work. The tree is found in the mountain scrubs of Queensland, and could be shipped from Brisbane and Maryborough.

Red Cedar (*Cedrela Toona*). This resembles the wood last mentioned in colour, but is somewhat inferior. It is softer and lighter, and considerably coarser in grain. It planes and works very well, however, and would do for common cabinet work. It is already known in the English market as "Moulmein Cedar."

Yellow Wood (*Flindersia Oxleyana*). This is a light-yellow wood, strong, and fibrous. It works excellently, and is said to season well. It would do well for joinery and cabinet-work, and can be readily delivered at the shipping ports.

Myall (*Acacia Stenophylla*). A hard, dark-brown, close-grained wood, with a good figure. It is much used by cabinet-makers and turners. The tree, which is small, is found in all the Australian Colonies. The sample sent planed excellently, showing a very smooth surface.

WESTERN AUSTRALIA.

Karri (*Eucalyptus diversicolor*). Like all the Eucalypti, this is a hard timber. In colour, it is of a light red tint. A log 3 feet in diameter, planted in the yard at Stanley Works to represent a growing tree, was cut down by the Steam Tree Feller; and another log of the same size was cross-cut, as it lay on the ground, by a similar machine. In each case the operation was completed in about three minutes. The wood was operated on in the following ways:—The rail-seatings were adzed on a sleeper and the spike-holes bored, giving satisfactory results. A plank passed through the

vertical frame, produced clean sawn boards; spokes and hammer-handles were also turned out satisfactorily. The tree, which is abundant in the Colony, attains colossal proportions; stems having been measured to a height of 300 feet without a branch, and with a girth of 60 feet at the base. This timber has been quite recently imported into London, and can be purchased at from £7 to £8 a load at the Docks.

Jarrah (*Eucalyptus marginata*). This, the most plentiful of Western Australian timbers, is beautifully marked, and somewhat resembles mahogany in colour. Railway sleepers, joinery, casks, spokes, and hammer-handles were made from it. The planed and moulded specimens, unlike the Karri, which does not finish well, left the machines with a remarkably fine surface. The wood is largely used in Western Australia for railway-sleepers, furniture, and joinery, and is especially adapted for piles, as it resists the teredo. The best jarrah is found on the hill ranges about twenty miles from the sea-coast, and being easily accessible, can be delivered in London for £7 a load.

Raspberry Jam Wood (*Acacia acuminata*). This is a dark, reddish-brown wood, close-grained, hard, and with a fragrant scent, from which it derives its name. The tree, which is small, is abundant throughout extra tropic Western Australia, and should find a ready sale in this country for ornamental wood-work.

York Gum (*Eucalyptus loxophleva*). This is a light-pink wood, close-grained, hard, and heavy. The samples submitted, being very small, only spokes could be made from them; for which purpose the wood seems eminently adapted.

Tuart (*Eucalyptus gomphocephala*). This wood is of a light-brown colour, heavy, durable and tough. From the sample sent, some felloes were shaped and some spokes turned; the finish from both machines being all that could be desired. The timber is used in the Colony for railway wagons, wheelwrights' work, and ship-building.

Wandoo (*Eucalyptus redunca*). This wood is very similar to the last described; and is used for the same purposes. Felloes were shaped, and spokes turned from it, the finish being, if anything, superior to that of Tuart.

NEW ZEALAND.

Kauri (*Dammara australis*). This is undoubtedly the best of all soft woods, being remarkably sound, durable, and straight-grained. The trials of this wood included making doors, straight and circular mouldings, match-boarding, and other joiners' work, as well as casks and engineers' patterns, for all of which purposes the practical men who witnessed the trials agreed that the wood was perfect. It planes across the end of the grain quite as well and smoothly as with it, stains well, takes a good polish, and would be valuable for bedroom furniture. This timber has been imported into this country, in small quantities, for several years past; fetching from 3*s.* to 3*s.* 6*d.* per cubic foot at the Docks. The tree, which is found in the province of Auckland only, attains a height of 120 feet,

with a maximum diameter of 15 feet. The plank sent to be experimented on was 5 feet 6 inches wide, absolutely clear of knots and shakes, and apparently as true as when first sawn from the log.

Black Pine (*Podocarpus spicata*). The Maori name for this wood is Matai. For a pine wood, it is rather hard. Match-boarding, straight and circular mouldings, and framing were prepared from it. The surface left by the cutters was excellent, and from the nature of the wood, a high rate of feed can be maintained. It is used extensively for house-builders' and joiners' work, and might well be employed in this country for similar purposes.

Red Pine, or Rimu (*Dacrydium cupressinum*). This is a very similar wood to the one last described. It was passed through the same machines, at the same rate of feed, and left an equal finish. Like the black pine, it is used for builders', joiners', and cabinet-makers' work.

Totara (*Podocarpus totara*). This wood is of the same nature as the two last described, and was tested in the same ways, with excellent results. If anything, totara is slightly softer than either black or red pine. It is used in the Colony for a variety of purposes:—builders' work, joinery, furniture, bridge-building, railway sleepers, &c.

CAPE OF GOOD HOPE.

Upright Yellow Wood (*Podocarpus Latifolius*). This wood is of a light-yellow colour, evenly-grained, and proved very easy to work. At the trials, it was passed through the vertical frame, and was found to saw very clean with a rapid feed. It was passed through the planing and moulding machines with a feed of 40 feet a minute, leaving a fine and very smooth surface. A door made from it was much admired. The wood is extensively used in the Cape for coach and wagon-work, and all general building purposes, and is well adapted for furniture. The tree is plentiful in the forests of George, Knysna, and Amatola, attaining an average height of 75 feet, with a diameter of 2 feet.

Umzumbit, or Umtiza (*Milletia Kafra*). This is a remarkably hard and heavy wood; the heart is of a very deep red colour, the sap wood being of a pale yellow. From the small sample sent, some tool-handles were turned, and presented a very fine appearance. Being very hard, of a somewhat greasy nature, and free from resin, Umzumbit is considered an excellent wood for bearings; the result of some experiments with the diamond-polishing machines at the Colonial and Indian Exhibition showing that it will last nearly seven times as long as *Lignum vitæ*.

Sneeze Wood (*Pteroxylon utile*). This wood, which is of a light-yellow colour, is hard, heavy, and durable. From the sample sent, a square post was sawn out, planed, and mortised, and some mouldings struck, and although hard, the wood works well. The heart-wood is impervious to the white ant and the teredo, and is therefore most valuable for fencing, piles and fencing-posts, and it is much esteemed in the Colony for wagon-making and cabinet-work. The timber is plentiful both in Cape Colony

and Natal, and could be readily conveyed to the ports for shipment; but its irregularity of growth prevents it being used for work heavier than that referred to above.

Stink or Laurel Wood (*Oreodaphne Bullata*). This is a heavy wood, dark-brown in colour, which, when polished, looks almost black. The specimen submitted was converted into match-boarding, straight and circular mouldings, panels, and framing. The wood proved easy to work in all cases, and left the cutters with a good finish. Its chief use in the Colony is for furniture; it is also used for joiners' work and wagon-building. The tree is plentiful in the virgin forests of Tzitzikama, but commands too high a price in the Cape to make it likely that it will ever be largely imported into this country.

CEYLON.

Milla (*Vitex altissima*). This is a straight-grained, handsome wood of a grey colour. It is used in the island for furniture and cabinet-work. The tree, which is abundant in the Central Province, grows to a height of 40 to 50 feet. The small sample sent was planed and moulded, in both cases leaving an excellent surface.

Hal-milla (*Berrya Ammonilla*). A reddish-brown wood, flexible, and tough. This wood is much used for making casks; as, however, the specimen sent was too small to convert into staves, heads for casks were planed, rounded, and bevelled, the wood working very clean. This tree is common in the low land of the Eastern Province, and grows to a height of 60 to 70 feet, with a diameter of 1 ft. 6 in.

Kumbuk (*Terminalia glabra*). This remarkably hard and heavy wood, in colour deep red, is found in the south of Ceylon, where its chief use is for making sluices in connection with irrigation works. In working it on the machines, however, it proved, for finish, fully equal to any of the woods experimented on, and judging by the framing made during the trials, should prove useful for joiners' work. Probably the hardness of the timber, which would make it difficult to work by hand, is the cause of its being so little used in Ceylon.

BRITISH NORTH BORNEO.

Billian, or Borneo Ironwood. This is a heavy, hard, and durable wood of a dark sand colour, which, when the wood is seasoned, turns to a deep red, and after long exposure becomes as black as ebony. It is exceedingly sound and tough, proving more than 50 per cent. stronger than English oak in resisting a breaking strain. From the log provided railway sleepers were cut, adzed, and bored, planks were sawn in the vertical frame, match-boarding, and straight and circular moulding prepared. The wood, being

very hard, was passed through the machines at a somewhat slow rate of feed, the surface left being remarkably fine. The tree, which is common throughout North Borneo, is found in swampy forests, on the banks of rivers, and the sea coast. It is proof against the teredo and the white ant, and is consequently in great demand for wharf-piles and planks in the Straits Settlements and China. This wood should be largely imported into England, as it could be sold at the London Docks with a good profit at 3*s.* 6*d.* a cubic foot, and might take the place of greenheart and teak for many of the purposes for which those woods are now employed.

Russock. This is a brownish-pink wood, rather hard, and rough grained. During the trials match-boarding, straight and circular mouldings, and door panels were prepared. It is extensively used in the Colony for builders' and joiners' work. The tree, which grows to an average height of 60 feet without a branch, has a diameter of 2½ to 4 feet. As it grows at the water's edge it is easily accessible, and could probably be delivered at the North Borneo ports ready for shipment for about £5 per load.

Selangan Batu (*Serayah*). This is a rather soft, light-coloured wood, and being easily worked it is largely used for joinery, house-building, and furniture purposes in India and China. During the experiments, a door-frame was made from it, the panels being of russock, previously described. Specimens were also passed through the various planing and moulding machines with a rapid feed, the finish being in all cases most satisfactory. The tree grows to a large size, and is abundant throughout the country. This wood is offered at the low price of £1 10*s.* per 40 cubic feet, delivered ready for shipment at the port, and from its cheapness and useful qualities, should prove highly remunerative to the importer.

WEST INDIES.

The Bahamas.

Horse-flesh Mahogany. This is a dark red, heavy, and rather hard wood, much valued for the framing of houses, high-class joinery, and shipbuilders' purposes. It is impervious to all insects, and of very great durability, having been found perfectly sound after a century of exposure. The ship's knee, sent as a sample, was cut up and converted in the following ways:— Straight and circular mouldings were run, leaving a most excellent surface; panels planed, with like results; a piece of framing mortised and tenoned, and some spokes turned; the wood proving in all cases easy to work. The tree, which is abundant in the Bahamas only, attains a height of 30 feet.

British Honduras.

Red Wood. This is a hard, close-grained wood, of reddish-brown colour, with a good figure. The tree grows to a height of 60 to 80 feet, with an average diameter of 1 foot. The sample sent, though hard, cut

very clean on the saw bench, and left the planing machine with a very smooth surface. This wood is well worth the notice of cabinet-makers.

Black Mangrove (*Rhizophora mucronata*). This is a dark-brown wood of a greenish hue, cross-grained and heavy. The sample submitted, being very wet, planed badly. It is, however, used in the Colony both for building and cabinet work; so possibly, if carefully selected and properly seasoned, it would give better results. The colour and figure of the wood are worthy of notice. The tree, which grows in swampy ground, attains a height of about 50 feet, with an average diameter of 20 feet.

In conclusion, I must thank the staff of the Royal Commission and the representatives of the various Colonies for the very valuable information and assistance they have given me throughout these experiments.

LIST OF WOODS DRIED BY THE COOL-AIR PROCESS.

Name of Wood.	Colony.	Weight when put in.		Weight when taken out.		Condition when sent.	Remarks.	Shrinkage.	
		lbs.	ozs.	lbs.	ozs.			Width.	Thickness.
Bean Tree	Queensland	4	12½	4	1½	Very wet	Neither shaken nor warped	1/16"	1/64" bare
Swamp Mahogany	New South Wales	4	8½	3	15	Wet	Not shaken; slightly twisted	1/4"	1/16" full
Blue Gum	New South Wales	4	10½	4	0½	Wet	Shaken, and slightly twisted	1/8" full	1/32" full
Ironbark	New South Wales	5	3¾	4	14	Wet	Very much shaken; not much twisted	1/16" full	A shade
Blackwood	Victoria	3	4	3	2	Dry	Slightly shaken and twisted	1/16"	A shade
White Box	Victoria	5	2	4	15½	Three parts dry	Slightly shaken; scarcely twisted	1/32" full	1/64"
Red Gum	Victoria	4	8¾	4	6½	Half dry	Not shaken or twisted	1/16"	1/32" bare
Blue Gum	South Australia	4	13	4	8¾	Wet	Not shaken or twisted	1/32"	1/64"
Sugar Gum	South Australia	5	5¾	5	1½	Very wet	Surface shaken; not twisted	1/16"	A shade
Karri	Western Australia	4	6	4	2	Half dry	Somewhat shaken and twisted	1/16" bare	1/32"
Jarrah	Western Australia	4	2¾	3	10½	Wet	Not shaken; slightly twisted	3/32"	1/32" bare
Tuart	Western Australia	5	7½	5	1½	Very wet	Not shaken; slightly twisted	1/32" full	1/64"
Black Pine	New Zealand	2	14½	2	10	Dry	Slightly shaken; not twisted	1/32"	Not at all
Red Pine	New Zealand	3	1½	2	14½	Dry	Not shaken; slightly twisted	1/16"	1/32"
Totara	New Zealand	3	5½	2	15	Half dry	Very slightly shaken and twisted	1/16" full	1/32"
Kauri	New Zealand	2	14½	2	11¾	Dry	Perfectly sound; slightly twisted	1/32"	Not at all

LIST OF WOODS DRIED BY THE COOL-AIR PROCESS—*continued.*

Name of Wood.	Colony.	Weight when put in.		Weight when taken out.		Condition when sent.	Remarks.	Shrinkage.	
		lbs.	ozs.	lbs.	ozs.			Width.	Thickness.
Black or Swamp Ash	Canada	2	13¼	2	3	Wet	Not shaken; very slightly twisted	3/32"	1/64"
Douglas Fir, 1st quality	Canada	2	3¼	2	0⅜	Dry	Not shaken; slightly twisted	3/32"	A shade
Douglas Fir, 2nd quality	Canada	2	11	2	7½	Half dry	Not shaken; slightly twisted	1/8" full	1/32"
Yellow Wood	Cape of Good Hope	2	6½	2	4⅜	Moderately dry	Perfectly sound; very slightly twisted	1/16" full	1/64"
Stink Wood	Cape of Good Hope	3	6	3	3	Dry	Perfectly sound; slightly twisted	3/32" bare	1/32" bare
Billian	British North Borneo	5	5½	4	15½	Very wet	Surface shaken; not twisted	Not at all	Not at all
Russock	British North Borneo	3	0¾	2	10	Three parts dry	Perfectly sound; twisted	1/16"	1/64"
Serayah	British North Borneo	3	2¾	2	12½	Half dry	Sound; not twisted	1/16"	1/64"
Lagerstrœmia	India	4	5¼	4	0	Dry	Shaken; twisted.	1/8"	1/64" full
Blackwood	India	4	5¼	4	0	Half dry	Perfectly sound; very slightly twisted	1/16"	1/32"
Sissoo	India	5	6	5	3	Half dry	Slightly shaken and twisted	1/32"	A shade
Padouk	India	3	1⅜	3	0	Dry	Perfectly sound and true	1/32"	Not at all
Chugalam	India	3	3	2	13½	Dry	Twisted and shaken	1/8"	1/32"

MACHINERY.

By WILLIAM ANDERSON, M. Inst. C.E.

CANADA.

AGRICULTURAL MACHINERY.

By far the largest and most important Exhibit of Machinery was that arranged by the Dominion of Canada, and, as might be expected, it was chiefly of an agricultural character. It will be convenient to examine it in the order in which it is used in farming operations.

Ploughs.—The ploughs exhibited presented a wide range of construction, both in quality and design, the several implements being, no doubt, suited to the means of the purchasers and the nature of the land to be cultivated. The leading features are, perhaps, the prevalence of riding ploughs, the use of the skim and disc coulters, short digger breasts, large socks, and the extensive use of cast steel. Messrs. J. B. Bedard and Son exhibited three heavy wood-framed implements of rough but serviceable make, and very low price. The Cockshutt Plough Co. had a very fine collection, among which may be noted a double-furrow riding plough for two horses, with wheel coulters and short mould boards; the depth of ploughing is capable of being regulated by means of a lever beside the driver, and the plough can be lifted right out of the furrow by a like arrangement. A similarly designed single-furrow plough was also shown, and is in every way an admirable implement. Several gang ploughs, for various purposes, were exhibited. In all steel, both wrought and cast, is the dominant material, giving the implements great strength, with lightness and elegance of appearance Many of the details are novel and ingenious. Messrs. G. Wilkinson and Co. exhibited several ploughs approaching more in form to those used in this country, wooden stilts and beams fitted to cast steel bodies, a combination forming well-made and substantial implements.

Mr. D. Ross showed a steel plough very highly finished. Its general design and proportions are much the same as those in vogue here, but the workmanship and finish are evidently intended as evidence of what can be done in that direction in the Dominion.

Cultivators.—Only one true cultivator was shown. It was by Messrs. J. O. Winser, Son, and Co., and is a remarkable implement in every way. The tines, instead of being of the massive proportions usual, are of flat spring steel, $1\frac{3}{4}$ inches wide, by $\frac{3}{16}$ inch thick, they are bent into a ⊃ shape, the lower ends are rounded and sharp, the upper ends bent round and secured to stout wooden rolls or beams, three of which, each armed with five tines, arranged so as to hit and miss, traverse the machine and cultivate a space 4 feet 6 inches wide. The implement is carried by two light wooden wheels of large diameter, and is drawn by a pair of horses. It is used after the plough, and is said to be very efficient in tearing up scutch and other weeds. The extreme lightness and springiness of the tines cause them

to yield under extreme pressure, so that the machine is said to be durable as well as efficient. Mr. G. Gillies exhibited a two-horse cultivator harrow, in which the framework is of steel in three sections; it is heavier than that of an ordinary harrow and is armed with short cultivator tines.

Horse-hoes.—Messrs. Boyd and Co. exhibited a horse-hoe with expanding wood frame and wood stilts, a cheap substantial implement; and the Cockshutt Plough Co. showed an admirably made hoe, all steel, expanding frame fitted with a pair of angling digger breasts, the whole forming a very light and strong implement.

Harrows.—Harrows were shown by Mr. G. Gillies, by Messrs. Boyd and Co., and by Mr. D. Ross; they are of similar design and proportions, made entirely of steel, in four sections adapted to two horses. Beyond being of sound and substantial make they present no features of special interest.

Drills or Sowing Machines were exhibited by Messrs. Coulthard, Scott, and Co., and by Messrs. J. O. Winser, Son, and Co. The two machines differ very slightly in principle, they each run ten drills, and are fitted with seeding and broad-cast arrangements. Messrs. Winser's machine has, however, a very light and apparently strong tubular frame, and is also fitted with their spring cultivator tines. Both are well-made, serviceable implements, fitted with all the adjustments usual in complete machines. Messrs. M. Moody and Sons showed a more compact and cheap seeding machine and broadcast sower; it is of simpler make, has fewer adjustments, and seems well suited to moderate means.

Reaping Machines, Harvesters, and Mowing Machines formed a very important part of the interesting exhibition made by Canada. Messrs. J. Elliott and Son, Messrs. A. Harris, Son, and Co., Messrs. McFarlane, Thompson, and Anderson, the Massey Manufacturing Company, the North American Manufacturing Company, Messrs. L. D. Sawyer and Co., exhibited implements of various degrees of excellence. The general features of the machines again show the elegance and solidity of design arising from the liberal use of steel castings. The machines approximate more closely to those of our best makers than do the implements made in the United States. The mowing machines are all of excellent design and finish, while some of them have ingenious and peculiar motions, notably a mower exhibited by the Massey Company, in which the movement of the knife is produced by the rolling contact of a pair of differential bevel wheels. The arrangement is exceedingly simple and compact, and is said to be efficient. The mowers cut the usual width, they are adapted to one or two horses, and are very complete in the mechanism which gives control to the driver. The implements exhibited by A. Harris, Son, and Co. are especially remarkable for lightness and elegance of design. The reaping machines are represented by automatic sheaf-binders or harvesters, and by ordinary machines. They are all, as is common in America, intended to cut high, and to deal with short and light straw. The harvesters are all string machines, with knotters of the Appleby type, with rotatory string holders mounted, with but one exception, on rocking frames. No special features are noticeable, though the several makers have their peculiar improvements in details. The Massey harvester and reaper are both admirable implements, and Messrs A. Harris, Son, and Co. showed equally highly finished and well-designed machines; both firms had evidently taken great pains

to make their exhibits worthy of the great Colony they represented. Messrs. J. Elliott and Son adhere to the method of driving the knife by means of a lever working under the platform of the machine, and actuated by a long pitman in the rear. In two of the reapers the movement of the rakes is not satisfactory, and there is a considerable difference in the finish and design, indicating an effort, on the part of some of the makers, to produce low-priced machines.

Hay Tedders.—Three were exhibited by Messrs. Boyd and Co., Messrs. J. O. Winser, Son, and Co., and by Messrs. J. C. Wilson and Co. They are all of the reciprocating class, having six forks actuated by six throw cranks, driven directly by pinions gearing into annular spur wheels, secured to each of the road wheels which thus actuates three cranks. Either set of forks can be thrown into gear independently of the other. The machines are made mostly of wood, and are of simple and serviceable construction.

Horse Rakes were largely represented, no less than seven implements being shown. They vary a good deal in construction, from the simplest possible designs to the complete machines of J. O. Winser, Son, and Co., and the Watson Manufacturing Company. These are fitted with automatic arrangements for clearing the rakes, and seem to be very complete machines. The tines, or rake teeth, seem very light compared with the strength of prong in vogue in this country, but doubtless the elasticity of the material compensates for apparent want of solidity.

Hay Loader.—The Watson Manufacturing Company showed an elevator for loading hay carts. It has the general appearance of a short and wide elevator, and consists of an open drum placed near the ground, and fitted with six rocking rake-heads which catch up the hay and deposit it on a skeleton travelling band consisting of two side chains and seven intermediate parallel cords crossed at frequent intervals by wooden cross-bars; these travel the hay to the top of the elevator and deposit it on the cart.

Threshing and Winnowing.—The most conspicuous exhibit was that of the threshing and winnowing machines, most of which present characteristics with which the shows of this country are unfamiliar. The threshing machines are, as a rule, much more simple in character; the drum is placed low, so that the feed can be effected either from the ground level or from a stage not more than three feet above it; the drum is usually a close cylinder armed with spikes, and revolves upwards against a concave, which is also spiked, and placed above the drum instead of under it, as is the custom here. The corn is fed in transversely, so that the straw is very much mashed and cut; but this is of little consequence on account of its low value. The corn and straw are carried on by shakers of various kinds, and such of the ears as have been imperfectly threshed, and are, therefore, too heavy to be carried out by the fan blast, are returned by Jacob's ladders or creepers to the drum, and are threshed a second time. No attempt is made for the most part to separate the different qualities of grain.

Mr. John Abell exhibited a full-sized steam thresher of substantial make and good finish, fitted with a straw elevator and efficient cleaning apparatus, also a small and simple machine suitable for moderate holdings, and a clover huller of very excellent design and make.

Messrs. J. and S. Bessette, Messrs. Boyd and Co., Messrs. M. Moody and Sons, showed compact and simple machines intended for farms of mode-

rate area and means. J. Larmonth and Co. exhibited a very well-finished machine, in which the cleaning of the grain is better attended to.

Messrs. Morris and Watts had a machine which approaches more nearly to those we are accustomed to see here. The separation of the grain from the straw, the shaking and screening are much more elaborate, and the same may be said of the threshing machine exhibited by Messrs. Stevens, Turner and Burns; both these machines should deliver the grain in a fairly complete state of cleanness. The woodwork in all the machines shown is excellent, both in the quality of the material and in the precision with which it is put together.

Winnowing Machines.—The number of winnowing machines or fanning mills exhibited seems to point to the circumstance that a considerable proportion of the threshing is done by hand, or by machines of very simple construction, and, probably, in the winter, when out-door employment is scarce. The machines present no special features of interest, except that some of them are of large dimensions and fitted up with more elaborate screening tackle than is common in similar implements in this country. Messrs. W. Forsyth, Manson Campbell, and Edward L. Goold and Co., were the exhibitors. The machines are all characterised by good design, substantial make, and good finish.

Hay-pressing Machine.—Messrs. J. and T. Bessette showed a fine horse-power pressing and baling machine. It consists of a strong iron-bound wooden frame, rectangular in plan, and about fifteen feet high, standing on the ground and enclosing a stout wooden box, the bottom of which is formed by a rising table or platform. Under the bottom of the box are passed a pair of long horizontal beams furnished on their top sides with iron rails, along which run pairs of wheels fitted to the lower ends of a pair of wooden toggle bars, the upper ends of which are jointed to the rising platform. The lower ends of the toggles are connected to each other by means of a $\frac{5}{8}$-in. chain, which is run through suitable pulleys and carried to a powerful horse-capstan with a spiral tapering barrel, by the action of which the lower ends of the toggles can be drawn together, and by so doing the moveable bottom of the box is forced up. The peculiar arrangement described has the effect of steadily increasing the pressure exerted by the horses, partly because the vertical movement of the table becomes less in proportion to the horizontal movement of the lower ends of the toggles as the angle between them becomes more acute, and partly because the diameter of the capstan barrel diminishes as the resistance increases. The capstan is fitted with a long and stout pole, which is capable of being thrown in and out of gear by means of a lever bolt placed about the middle of its length. Two horses can be harnessed to the pole and travel in an ordinary circular track. The sides of the box, at its upper end, are made to open, the doors being hung on powerful hinges, and just beneath these are stages on which the operators stand. The material to be pressed is fed in from above when the bottom of the box is down, pressure is then applied and when completed the sides of the box are opened and the bale secured by hoops or bands in the usual way, and then taken out of one of the side openings. The finished bales measure 3 feet 7 inches long by 1 foot 7 inches wide, they are compressed from about 9 feet to 2 feet 2 inches, and are secured by bands of iron or other material. The bales composed of hay weighed 278 lbs. or about 23 lbs. to the cubic foot.

Portable Engines.—Mr. J. Abell exhibited two portable agricultural engines, one at ten-horse power, compound, and the other a twelve-horse single cylinder.

The compound engine is also a straw burner, and has a special furnace attached under the barrel of the boiler and in front of the fire-box. The fire-grate is of about the usual proportion, the straw is fed in from fire-doors fitted with self-closing lids placed on each side, and the ashpan is fitted with dampers. The flame enters the ordinary fire-box through an aperture in the front end, and so passes to the tubes in the usual manner. There is also an ordinary furnace door in the rear of the fire-box intended for use when coal or wood is burnt. The cylinders are placed side by side at the fire-box end, and actuate separate cranks placed opposite to each other. The slide valves are of the piston type; the steam exhausted from the high-pressure cylinder is carried through the steam space of the boiler and through a portion of the fire-box before it reaches the low-pressure cylinder in order that it may become superheated. From the low-pressure cylinder the exhaust escapes into the chimney in the ordinary way. The feed delivery pipe also takes a turn in the smoke-box. The engine is self-contained—that is to say, the cylinders, guides and crank shaft pedestals are connected by a casting, and are by that means tied together independently of the boiler. The steam pressure is 150 lbs. per square inch, there is but one spring safety valve of moderate dimensions, and the usual water and pressure gauges. The feed is supplied by an injector, and the several working parts of the engine are provided with the usual adjustments. The road wheels are of wood with metal naves, the pair at the rear end are attached to the sides of the fire-box by means of stout brackets independently of each other, and the weight of the engine rests on spiral springs. The fore-carriage is composed of a compound bar pivoting on a central pillar attached below the smoke-box. The engine looks a strong serviceable job, but the finish is not so high as would be expected from a good maker in this country.

The single-cylinder engine has an ordinary coal-burning fire-box, and is intended to work at 100 lbs. pressure; but in other respects closely resembles the compound engine. Besides the injector there is a feed pump worked by a crank actuated by a belt from the driving shaft. The object of the pump is probably to raise feed water from a depth greater than the injector could reach. Mr. Abell deserves credit for adopting high steam pressure, his compound engine is probably very economical in fuel and water.

Mr. White showed a portable engine with a cylindrical boiler fitted with a cylindrical furnace flue and return tubes, the chimney being at the furnace end. It has a single cylinder, the connecting rod of which actuates a crank disc. The engine is self-contained, and is attached to the side of the boiler a little below the top. The feed is supplied by a pump placed below the cylinder and actuated by an arm off the crosshead. The feed-water is passed through a feed-heater supplied with waste steam and placed in the smoke-box. The travelling wheels are all of iron, the rear axle cranked under the boiler, the weight of which is taken on rubber springs. The fore-carriage is a single bar pivoting on a support secured to the underside of the boiler. The engine is fitted with a single safety valve, a governor, and the usual gauges. The pressure gauge is graduated to 160 lbs. This engine is an

instance of wide departure from established type, but the design and execution are so good that it probably will prove very efficient and durable.

Messrs. Stevens, Turner and Burns showed an engine of the ordinary type, except that the fire-box has a "wet bottom"—that is to say, the water space is carried below the grate, access of air to the ashpit being through a second opening in the back end of the fire-box a little below the furnace door. The engine has a single cylinder with connecting rod actuating a crank disc; it is self-contained, and secured to the side of the boiler near the top, the cylinder being turned to the fire-box end. Feed is supplied by an injector, which delivers into a feed-heater supplied with waste steam, and arranged in the bedplate of the engine. The chimney is fitted with a large spark catcher. There is but a single safety valve and the usual pressure and water gauges, the pressure gauge being graduated up to 200 lbs. The wheels are of wrought iron of very large diameter, the rear axle is bent and passed under the boiler, the front carriage is a bar well stiffened by a steel casting, and supported by a stay to the boiler. The engine is a very substantial job, and the boiler, being unlagged, shows the workmanship, which is excellent.

A remarkable feature of the Canadian machinery is the amount of decoration that appears to be considered necessary. In this respect there is a close affinity with the practice in the United States and a wide divergence from the unadorned style of our own makers.

Wood-working Machinery.

Mortising and Boring Machines.—Three tools of similar form and mode of action were exhibited by Messrs. McKechnie, McGregor Gourlay and Co., and Cowan and Co.

They are excellent machines, entirely of metal. The work is placed on a table, which can be raised and lowered by the foot of the operator. The table is fitted with a side guard or gauge, which can be adjusted to the thickness and width of the wood, and is provided with a narrow flange or ledge to keep the work from being dragged up by the tools. The traverse is operated by hand. The chisel turns automatically, as the table falls, or remains stationary at the pleasure of the operator. An auger, in Messrs. McKechnie's machine, is placed beside the chisel, it is driven independently and can be raised or lowered by a separate hand lever.

Band Saws.—Two band saws were at work exhibited by Messrs. McKechnie and McGregor Gourlay and Co. Both are capable of taking in 32 inches deep, and are very like in general design to each other and to similar tools in use in this country. The tables in both can be canted for bevel cutting. The principal difference between the two machines is in the guides to the saws and in the mode of tightening them. In Messrs. McKechnie's machine the saw is supported by case-hardened guides, in Messrs. McGregor's saw the blade is held up at the back by a steel roller and by wood guides laterally. In one machine the tightening arrangement is a screw and spring, in the other a screw only is used. The saws were excellent tools from every point of view.

Planing Machines.—Gourlay and Co. exhibited a panel planing and thicknessing machine of excellent construction; the timber is fed in by rollers, the revolving cutter is over the work, and the guards are arranged to throw

the shavings clear of the rollers, so as to avoid the risk of marking the wood by their getting between it and the rollers on the finished side. The bed rises and falls to gauges, and the cutter is driven on both sides so as to equalise the strain on the bearings. The machine takes in a width of two feet. Messrs. Cowan and Co. exhibit a similar machine of equally good construction. They have a simple arrangement for taking off the feed instantaneously by means of a tightening belt-roller carried by a lever on a rocking shaft.

Tenoning Machines.—The same firm showed a tenoning machine which finishes the tenon on both sides, and is fitted also with a pair of moulding heads for adapting the shoulder of the tenon to the mouldings of the rail it fits into. These heads are driven independently, and have a rise and fall motion, as well as a relative motion to each other, operated by means of a single compound screw of ingenious but simple construction.

Messrs. McGregor Gourlay and Co. showed a univeral wood-worker for planing one side and both edges of planks simultaneously; the edges can be worked to any form, and the machine is fitted with chamfering guides. This is a strong, compact, and useful machine. Messrs. McKechnie exhibited a moulding machine of very substantial make, it will finish all four sides of the timber to any pattern at the rate of 30 feet per minute; there is nothing specially noticeable in the details.

A novel feature of most of the wood-working machines was the form of the loose pulleys. These, instead of being of the same diameter as their fast pulley, as is generally the case, are considerably smaller, about 1½ inches in the diameter; an abrupt O. G. moulding brings the diameter up to that of the fast pulley. The belt seems to travel over quite as easily as when the pulleys are of equal size, and the great advantage is attained of the strain being relieved from the belt, the shafting and the bearings when the machines are not at work.

Saw Setting Machinery.—A very complete plant for making, sharpening, and setting circular saws was exhibited by the Wm. Hamilton Manufacturing Co. The sharpening machine consists of a bevelled emery wheel driven at high speed, and raised and lowered by a cam action. The saw is pivoted on its centre and turned automatically by a feed motion engaging into its own teeth. The machine can deal with saws ranging from 6 inches to 6 feet in diameter.

A simple but very complete apparatus for topping the teeth of circular saws, and giving them the necessary "set," was also shown. The saw is pivoted on to a rocking pillar and can be turned into the upright or horizontal position. An anvil, which can be adjusted to any distance from the centre of the saw, receives the teeth, which are then easily set by means of a hand hammer. The topping is done by means of a file held in a clamp, which can be advanced by a screw motion like a slide rest.

Metal-working Tools.

Messrs. McKechnie and Bertram were the only exhibitors of engineers' tools, and they deserve great credit for their enterprise in sending so excellent and varied a collection to the Exhibition. Their exhibit consisted of the following:—

An 8-inch double-geared screw-cutting lathe with a 7-foot bed, adjustable

back centre and rest with movable compound head, rack as well as screw movement to the rest.

A planing machine, to take in 20 inches wide, with five-foot table, quick return motion, self-acting vertically, horizontally, and at any angle

A shaping machine, with quick return motion, of ingenious and peculiar construction. The tool slide is driven by a crank on a vertical shaft, which is actuated by an eccentric pin on a horizontal bevel wheel placed under the slide; the axis of the crank shaft and bevel wheel are not in the same line, consequently the driving pin acts at a variable leverage on the crank shaft and causes the variations in speed.

A milling machine with horizontal cutter, self-acting vertically and horizontally, of strong and convenient make. No special arrangements seem made for the lubrication of the cutters, a point of great importance in this class of cutting tool. It is a matter of regret that no specimens of work done by the machine are shown.

A pulley-turning lathe, to take in 6-feet diameter, with two rests on opposite sides of the work. The feed motions are peculiar, being composed of long tangent screws placed at right angles to the line of centres of the lathe and along one side of each rest. The screws are driven at any desired speed by disc and friction roller, and engage into worm wheels connected to the rest screws by friction cones. The tangent screws are of such length that they will suit any diameter of pulley. The lathe is of very substantial make, but no appliances exist for turning the curved faces so commonly required in pulleys.

A very complete upright drilling machine, double geared and self-contained, including its own countershaft. It will take in 16-inch radius, has a rising and falling table which can be turned aside for large work, which can be accurately adjusted on the planed surface of the base plate, friction feeding gear, and a quick return for the drill, which, with its driving gear, is balanced by a chain and weight in the hollow standard of the machine.

Windmills.

The practical difficulty in making use of wind-power for domestic purposes lies in the automatic adjustment, which is essential where the apparatus is to work without supervision and at small cost for repairs. Many varieties of windmills have, from time to time, been introduced with this object, but few of them appear to answer their purpose satisfactorily, mainly on account of the large number of joints and moving parts, which the several systems rendered necessary.

The windmills exhibited by the Ontario Pump Company of Toronto, constructed on Halladay's method, seem to present advantages of design and construction which must recommend them strongly.

The sails are of the disc kind, but instead of being composed of a large number of individually movable radiating sail boards, they are arranged in six or eight groups, each group turning on pivots in the plane of the disc and at right angles to the mean radius, so that when it is desired to reduce sail, the ends of the boards are presented to the wind and not the edges, as in the common arrangement, the effect being that less surface is presented to the wind and the number of joints and sets of mechanism actuating them is reduced to six or eight. In addition the sections are so hinged that

the centrifugal force, due to increased speed of rotation, helps to turn the sail boards out of the wind and so reduces the effective sail area, thus giving the windmill considerable uniformity of speed in varying winds and minimising the possibility of injury from heavy gales, because only sufficient sail is carried to give the desired speed.

The pivot of each section is connected by rods and bell cranks in a simple and substantial manner to a disc sliding on the main shaft of the sail wheel, and the position of this disc, and therefore of the sail, is regulated by a bell-crank lever and balance-weight, which can also be controlled by means of a wire by the attendant on the ground, or by a float in a water tank, or by a loaded hydraulic cylinder in communication with the rising main of a pump when the mill is used for lifting water. The weight on the regulating lever is set to yield at any desired pressure or speed of wind.

The exhibitors state that they recommend using a mill of sufficient capacity to give the results desired by operating one-third of the time, and that such an allowance can be depended upon with safety; that a wind speed of eighteen miles per hour is taken as the standard for estimating horse-power, and that a sail disc eight feet in diameter will give one man power. Mills have been constructed of 60 feet in diameter estimated to yield 40 horse-power. The most common application of the mills is for raising water, and uniformly satisfactory results have been obtained where sufficiently large storage tanks have been provided, so that an occasional prevalence of calm has not been felt.

These mills are also used for the various operations about a farm, such as churning, threshing, corn crushing, and the like, and, as evidence of durability, it is stated that mills erected in 1863 are still at work.

The exhibit was highly creditable, because not only were two complete mills shown in action, one pumping water and another a geared mill with machinery attached for grinding, &c., but also a working model was exhibited to facilitate the explanation of the mechanism, and specimens of the various parts were shown on the ground.

VICTORIA.

Messrs. Beard and Sisson exhibited a hand-winnowing machine of substantial make and good design. The special features are a small elevator for raising the cleaned corn into sacks, and a light spiked roller over the shake behind the hopper intended to facilitate the removal of straw and chaff.

The same firm exhibited an implement quite new in this country—it is called a "stripper," and is used for the purpose of reaping and threshing crops of wheat, barley, oats, &c., leaving the straw standing on the ground to be either burned or gathered at leisure.

The "stripper" may be compared to a reaping machine, having very long and elastic fingers placed almost touching each other, but without a reciprocating knife, and, in lieu of the rakes, at the immediate rear of the fingers, is a light iron drum followed by a capacious galvanised iron cart-

body. The whole machine is connected to a side carriage fitted with a pole, and is drawn by two horses, much as a reaping machine is. The fingers are set very high, and the machine when driven into the standing crop tears off the ears which get caught between the fingers, and delivers them into the threshing drum, which whirls the corn and chaff into the cart-body. There are thirty-five fingers in a width of five feet, and a longer gathering finger and prong at each side. The carriage has a main road-wheel and a smaller front wheel just under the attachment of the pole. The front wheel acts as a steering wheel, and is controlled by a lever from the driver's seat. The machine can be raised or lowered by a vertical worm, operated from the driver's seat, gearing into a curved rack attached to the body of the implement, and secured by a spring catch operated by the driver's foot, who can also by the same means apply a brake to the main road wheel. The threshing drum is actuated by a belt driven by a pulley on a short counter-shaft, which is caused to revolve by a pinion gearing into an annular wheel secured to the spokes of the road wheel. There is no special concave for the drum to work against, the threshing is therefore probably only preliminary. The body or box of the machine is closed by capacious doors, covered with wire cloth, to permit the escape of the air sent in by the drum. The machine is of substantial design, and very well made.

Messrs. Kelly and Preston showed a double-furrow plough of very substantial make and elaborate detail. The coulter, socks, and mould-boards are very much of the form prevalent in this country. The width of the furrow can be adjusted by altering the lateral position of the rear plough by shifting it on a pair of screwed cross-bars which form its support from the main frame, and to which it is clamped by double nuts. An inclined bevelled wheel runs ahead of the leading furrow, and a similar one follows the second plough, while a land wheel is attached to a powerful lever by means of which the plough can be lifted for turning on the headlands. The leading wheel can be moved laterally by a lever extending to the rear of the plough, and secured there, by means of a spring catch, to a perforated segment, and it can be angled for steering purposes by another long hand-lever operated from the same point, and held at any desired position in a curved rack. The heights of both leading and following wheels can be adjusted independently of each other. Compared with the double-furrow plough in the Canadian section, the implement under consideration is remarkable for its great strength and solidity, pointing to a considerable difference in the nature of the ground to be cultivated.

Mr. John Tynan exhibited a single-furrow plough of the form and proportions adopted by the best makers in this country; there are no special features, but the implement is a fine example of design and workmanship.

SOUTH AUSTRALIA.

Messrs. J. W. Stott and Sons showed two implements which are new, or at any rate uncommon in this country. A "stump jumping plough and a cultivator." These machines are intended for the cultivation of rocky and

stumpy ground, and are so contrived that the cutting portions of the implements shall yield and pass over serious obstructions rather than attempt to cut through them or force them aside.

The stump jumping plough makes two furrows, and consists of a powerful frame mounted on two main wheels, made of iron, and a steering wheel of smaller size. To the frame is hinged a pair of plough bodies, that on the near-side being complete, with coulter lock and mould board; the one on the off-side being without the latter adjunct. On encountering a serious obstruction the ploughs yield, turning backwards, but as the traces are carried back and attached to the ploughs below the points on which they turn, the efforts of the horses tend to pull the ploughs back to the normal position as soon as the obstacle is surmounted. The main wheels are mounted on a cranked axle, on to which is keyed a powerful lever, by depressing which the axle is turned and the rear end of the implement is raised, while the same movement actuates a chain carried to the steering-wheel, on the vertical spindle of which the fore part of the frame can be raised or lowered simultaneously with the rear. The implement is of very strong design and excellent workmanship, indicating that the land on which it is intended to operate does not willingly yield its increase, but yet must succumb to the ingenuity of man. The wheels are of peculiar construction, and deserve a moment's notice. The tyres, of 2 inches by $\frac{1}{2}$-inch flat iron, have rivetted into them spokes made of $\frac{3}{4}$-inch square iron, the diagonals of the squares being in the plane of the wheel. The naves are in two parts, forming a pair of flanges united by means of bolts, and having, on their opposed faces, V-shaped radial recesses, into which the inner ends of the spokes fit, and are firmly secured by the bolts. The wheels appear to be very substantial, and the form given to them has the advantage that if any spoke should break or be injured, it can be readily taken out, repaired or replaced.

The second implement, a seven-tine cultivator, is designed for similar work. Each tine is attached to a separate body, pivoting in a massive main frame, and kept down by a weighted tail lever. The implement is mounted on three wheels, the rear ones working on a cranked axle which can be turned by a hand lever in the rear of the machine for the purpose of raising it, and the same movement actuates a chain carried to the steering wheel, which, by that agency, can be moved vertically on its vertical spindle, through the forward end of the main frame. In working ground encumbered with stumps, roots, and large stones, the tines of the cultivator yield backwards, and slip over any obstructions too solid to be torn up; but as soon as the difficulty is got over the weighted levers restore the tines to their normal positions. The implement is very strongly made, and looks like an efficient tool.

Messrs. James Martin and Co. exhibited a stripper substantially of the same design and construction as the one already described. The width is rather less, being only 4 feet 10 inches, and the fingers are fewer, there being thirty-six in the reduced width. The machine is somewhat better finished, and is in every way an admirably made implement. There was also a small model stripper exhibited, so that we must infer that the implement is of importance in the Colony where it seems to have originated.

QUEENSLAND.

Gold, in the quartz reefs of Queensland, occurs in the form of more or less minute particles diffused through the rock, frequently associated closely with pyrites, chiefly sulphides of iron and lead, and sometimes copper and zinc.

The process of extraction consists in crushing the rock, in the presence of water and mercury, into a very fine mud. The muddy water flows over copper plates covered with an amalgam of mercury, the pyrites is caught by ripples or hollows cut in the tables, and is afterwards ground finer still in the presence of mercury, when that which has been freed from the auriferous matter is suffered to flow away. The particles of gold during the process become amalgamated with the mercury; this amalgam is separated by straining through calico; the mercury is driven off by distillation, and the rich auriferous residue is melted and run into impure bars of about 84 per cent. of gold and 16 per cent. of silver.

The machine exhibited by the Queensland Commission was not a mere model, but was a full-sized working plant capable of dealing with about 70 tons of rock per week. It was in operation daily for a couple of hours, producing gold bars from the quartz rock sent over with it. It is impossible to speak too highly of the completeness of the exhibit and its important educational bearing, nor can the quality of the machinery and its finish be too highly extolled. Messrs. John Walker and Co., of Maryborough, have shown that Queensland can produce work as well designed and as thoroughly finished as any turned out by the best workshops of the Old Country.

The ore-crushing plant should, properly speaking, be placed on a hillside, so that the transfer of the material to the various processes should be accomplished by gravitation only; this arrangement was not possible at the Exhibition, so that the apparatus was not seen to the best advantage.

The first process consists of stamping the ore. The quartz rock is broken up into tolerably small fragments by hand, and is then fed by manual labour into a hopper communicating with a cast-iron box lined with side plates, which can be readily taken out and renewed. The stampers are five in number, each consisting of a solid wrought-iron rod, tappet, stamper-head and shoe, weighing in all 800 lbs.; these are raised and lowered about 9 inches, at the rate of 80 blows per minute, by cams or wipers keyed on a horizontal shaft which revolves just in front of the row of stamps. Each stamp has a screw-thread cut on it for a portion of its length—on this thread is placed the tappet, made in halves, and secured by clamping bolts; the lower wearing surface is a ring of steel, held up to the tappet by a pair of bolts. The effect of this arrangement is that the stamps as they rise are also turned through a considerable angle, and by that means caused to wear evenly. The cast-iron box in which the stamps work is of considerable depth so as to restrain the splashing, and the muddy liquid is suffered to escape through two apertures in the front, covered with fine steel-wire strainers of 40 meshes to the inch. It then flows over a series of copper plates covered with mercury, and arranged in terraces, the stream flowing over being very shallow so that the particles of gold, which naturally sink to the bottom, amalgamate and are retained on the plates. The terraces

are traversed by several shallow cross channels or ripples in which a good deal of the coarser auriferous pyrites is caught, and the stream falls finally into a percussion frame consisting of a long shallow box fitted with inclined trays, to which a sharp reciprocating movement is given by a coarse ratchet acting against a spring. The effect of this operation is to cause the pyrites which collect to travel up stream and to sort themselves according to specific gravity, the lighter particles, chiefly silica, flowing away to waste.

The auriferous pyrites collected from various parts of the machine has next to be ground finer, in contact with mercury, and this operation is performed in the following manner. The concentrated pyrites is fed into a "Boss" grinding pan, which consists of a large circular iron cistern, over the bottom of which are dragged eight segments of cast iron by means of a central revolving spindle and driving arms. The pyrites and mercury are by this means rubbed as it were together, and the gold amalgamated out. The "Boss" pan delivers into a pair of "Berdan pans," or large cast-iron dishes revolving at a considerable angle of inclination under a pair of heavy cast-iron mullers, attached to the fixed framework by means of chains. Pyrites, mercury, and water are placed in the pans at regular intervals. The point of merit is this part of the process seems to be to avoid "flouring" the mercury, that is dividing it into drops so minute that they will not readily settle in the water, but tend to escape with that which is run to waste.

The mixture of pyrites, mercury, gold and water, is next run into a large circular subsider, fitted with a revolving agitator so speeded that the auriferous matter will settle to the bottom while the lighter barren mud can be suffered to flow away through a series of overflow openings in the side of the vessel, the height of overflow being varied at pleasure.

The auriferous mud concentrated in the subsider is passed through the pans a second time. At regular intervals the amalgam is collected from all parts of the machinery and placed in an iron retort fitted with an iron lid and iron Liebeg's condenser; the retort is placed in a furnace, the mercury distilled off and condensed into a cistern of water. The cake of gold remaining is melted in a crucible and cast into ingots.

About 250 lbs. of mercury is in use in the apparatus, and very little of it is lost if the operation be carefully conducted. The copper plates are recoated about every four hours, and a complete "wash up" is effected once a fortnight, when the linings of the stamper-boxes are taken out and all the amalgam carefully removed. The ore contains generally from two to three ounces of gold to the ton. Mills with as many as 60 stampers are in use. The cost of recovering the gold ranges from 10*s.* to 20*s.* per ton of ore.

The machine above described was erected for the Queensland Commission by Mr. Longden, a mining engineer of long practice and extensive experience.

NEW ZEALAND.

Mr. George Ashcroft exhibited a small quartz-crushing and gold-saving machine of compact form, and requiring small power. It consists of a hemispherical pan, mounted on iron frames, traversed vertically by a spindle, the lower end of which is driven by a pair of bevel wheels, through the agency of a short horizontal driving shaft. The upper end of the spindle carries a cross, two arms of which are furnished with a pair of driving pieces turned downwards and fitted with small rollers like ordinary chair castors. These rollers press against a pair of 6-inch cannon balls, and drive them round the bottom of the pan, which is shaped so as to fit them. The alternate arms of the cross carry water jets supplied by a central pipe. The pan is surmounted by a funnel-shaped disk 2 feet 2 inches diameter, the sides of which are formed into rectangular apertures covered with fine wire cloth. The ore is placed in the pan, water is allowed to flow in, the cannon balls pound and grind the quartz till it is fine enough to flow with the water through the wire gauze into an annular trough 6 inches wide, which surrounds the funnel. From the trough the water flows into a tank 2 feet 8 inches long by 10½ wide and 2 feet 6 inches deep, the bottom of which is furnished with a pair of coarse cast-iron worms or creepers separated by a low diaphragm which stops a few inches short of either end. The worms are connected by a pair of spur wheels outside the tank, so that they revolve in opposite directions, and being the same hand, they cause the mud which collects at the bottom of the box to travel round and round, and to get thoroughly mixed with the mercury which is used to amalgamate with the gold. The subsequent treatment of the amalgam is probably the same as in every other process. The machine was not at work, so that it is impossible to pronounce any opinion as to its efficiency, but it is a well-made substantial tool, and if right in principle should act well.

The Natal Government Railways exhibited a very well made vertical boiler, the internal construction of which can only be conjectured. The shell is in two parts divided horizontally about the middle of its height and joined by closely pitched bolts. The fire-box is traversed by horizontal water tubes to which access can be obtained by removing the upper part of the shell. The form of boiler is well known in this country, so that the particular example under consideration is only remarkable for excellence of design and workmanship.

CAPE OF GOOD HOPE.

A complete plant for diamond washing, in full operation, attracted much attention. The machinery was made in England, but as it is the joint invention of Mr. Thaine Allen of Kimberley and Mr. Paxman, it may be fitly noticed in this report.

The diamondiferous earth is first mixed with some of the water flowing from the wash mill, and is then raised by means of a Jacob's ladder into a

hopper from which it flows, with some addition of fresh water, into an inclined revolving screen about 3 feet 6 inches diameter and 10 feet long, composed of longitudinal flat bars pitched about 1⅛ inches apart and connected by ⅜-inch round steel hoops set about 1½ inches apart. The sludge which passes through the screw falls into a trough beneath it, and is thence conducted by means of a spout to the wash mill, which is placed on a lower level and a little to one side of the screen; the pieces of earth which are too large to pass through, fall out at the end and are further broken up. The wash mill consists of a fixed circular pan 13½ feet in diameter with an inverted funnel-shaped bottom provided with a central opening guarded by a shallow ledge. A vertical spindle, driven by bevel gear from the top, revolves concentrically with the pan, and carries a number of arms fitted with stirrers which serve to keep the material on the conical bottom in constant motion. Higher up on the spindle is secured a cylindrical hopper from which issue a number of shallow radial channels forming a skeleton cone much in appearance like the ribs of a half-closed umbrella; these deliver the sludge (which flowed from the screen) into the revolving hopper, into the outer periphery of the pan, where it falls under the influence of the stirrers which comminute it further and permit the fine mud to flow off by the central opening of the pan. At the end of a day's work a sliding door is opened in the bottom of the pan, and its contents are discharged into a truck by means of two broad scrapers which can be let down at pleasure from two of the stirrer arms. The residue thus collected consists of all kinds of stones, which by virtue of their weight and of the centrifugal force imparted by the rotatory stirrers, have settled in the outer and deeper part of the pan. About 13,600 cubic feet of earth can be treated per day in a mill of the size described; the residue, amounting to about 30 cubic feet, is passed through a "pulsator," an apparatus in which there is a series of sieves of different meshes through which water flows at a suitable velocity to carry off the mud and lighter particles, leaving the diamonds, garnets, agates and other heavy stones behind. These are taken to the sorting tables, where the valuable stones are picked out. The washing water is used over and over again, partly from economy, and partly also because it is found better adapted to the process than clean water on account of its higher specific gravity. The coarser mud is separated by allowing the water to flow over inclined screens covered with fine wire cloth. The apparatus described is driven by a portable engine, the movements of all the parts being derived from a single driving shaft by the ordinary modes of transmission.

MUSICAL INSTRUMENTS.

By JOHN STAINER, M.A., Mus. Doc.

THE Musical Instruments exhibited were all in the Canadian Court, and consisted entirely of pianofortes and organs (*i.e.* American organs). Speaking generally, I may say that in both these branches I was much struck by the high standard of excellence reached, alike in tone and mechanism. It is hardly in my province to discuss the cost of production and the prices of these instruments as compared with those manufactured in England and elsewhere; but it is a noteworthy fact that a considerable number of pianofortes were sold during the Exhibition at the makers' ordinary prices; and, as regards the organs also, the existence in London of prosperous agencies and large dépôts of some of the leading manufacturers proves that they too are of commercial importance. But it must be remembered that "organs" are not to any great extent manufactured in England; the Canadian instruments must, therefore, be compared with other importations of the kind if it be required to find their musical merit or market value.

The general results of my inquiries as to the Canadian pianofortes convince me that the cost of production is greater in Canada than in England. This would prove that Canadian pianofortes of smaller dimensions and capabilities cannot profitably be sent into European markets. But on the other hand, some of the highest class of pianos showed such excellent qualities that I doubt not they could hold their own anywhere. It is of course a fact that true lovers of the pianoforte are prepared to purchase thoroughly good instruments from whatever quarter they may come, and, moreover, are prepared always to pay a somewhat "fancy" price for instruments of special excellence.

But whatever opinions may be held as to the value of the Canadian exhibit from a commercial point of view, there cannot be a shadow of doubt as to the fact that the Dominion is capable of supplying itself with both pianofortes and organs of admirable tone and workmanship.

I now proceed to give a list of the exhibits (in alphabetical order) which I visited, and I have ventured to append in many cases a few remarks on their merits.

LIST OF EXHIBITS OF MUSICAL INSTRUMENTS IN CANADIAN COURT, IN ALPHABETICAL ORDER.

W. Bell and Company (Guelph, Ont.; London Branch, 58, Holborn Viaduct, E.C.), Organs. All the instruments were excellent specimens, both with regard to tone and workmanship. I was particularly pleased with examples of styles 100, 125, 200, and 600, all of which possessed a tone of remarkable purity, and showed strong and sound mechanism.

Chute, Hall and Company (Yarmouth, Nova Scotia), Organs. I

examined specimens of their style, "The Parlor Beauty;" they were good and serviceable instruments.

Dominion Organ Company (Bowmanville, Ont.; London Agents, Forsyth Bros., 272A, Regent Street), Organs. I examined examples of various styles, all thoroughly good. A three-manual organ with registers of complete compass (not half-stops), and a complete pedal-clavier, reflected the highest credit on the makers, who have proved themselves capable of producing qualities of tone of remarkable variety.

Doherty (Clinton, Ont.), Organs. Three examples which I examined possessed very sweet tone and highly satisfactory action.

W. J. Gates and Company (Halifax, Nova Scotia) exhibited two instruments; both of them were good and cheap.

Heintzman and Company (Toronto, Ont.), Pianofortes. I much regret that owing to the late period at which I was called upon to make a report, all the more important instruments exhibited by this firm had been sold and removed. But those remaining fully justified their high reputation. An upright grand, which I examined (cabinet, style No. 15) was in every respect a fine instrument; the touch was sympathetic and had a good repetition, the tone was full and rich. I also tried a specimen of style No. 9, which was equally deserving of unqualified praise.

Karn and Company (Woodstock, Ont.), Organs. I consider these instruments highly meritorious; the tone was refined and delicate, and the mechanism uniformly good. I tried several specimens.

Lansdowne Pianoforte Company (Toronto). I examined an upright grand of satisfactory tone and workmanship.

Mason and Risch (Toronto), Pianofortes. This exhibit was altogether one of great merit; I found the instruments to be in all cases of good tone and touch. I considered style Nos. 2 and 3 (uprights) specially deserving of praise. A grand pianoforte (style No. 7, "Princess Model") was a fine instrument; the tone was exceptionally sweet and full.

Newcombe Pianoforte Company (Toronto). I was much pleased with many of these instruments; the tone and touch were always good, and I am sure they will prove serviceable.

Uxbridge Organ Company (Uxbridge, Ont.). A satisfactory exhibit of sweet-toned instruments.

R. S. Williams and Sons (Toronto), Pianofortes. I saw this exhibit under great disadvantages; the instruments had been subjected to sudden changes of temperature, and consequently were not in the best order; but as far as I could judge they seemed to be strongly constructed, useful instruments.

INDEX.

AFRICA, *see* Cape of Good Hope, Gambia, Gold Coast, Lagos, Natal, Sierra Leone *and* West African Colonies.
Agates in Canada, 58.
Agricultural Machinery, *see* Machinery, Agricultural.
Almonds in Queensland, 132.
Aloes in Antigua, 250; Barbados, 250; Cape of Good Hope, 250; Natal, 250.
Amethysts in Canada, 58; Ceylon, 83; Mauritius, 84.
Andaman Islands, coffee in, 173; tea in, 149; timbers in, 463.
Anticosti, timbers in, 412.
Antigua, aloes in, 250; chemical products of, 258; cigars in, 246; cocoa in, 181; coffee in, 174; fruit in, 145; spirits in, 228; sugar in, 189; resins in, 297; timbers in, 456; tobacco in, 246.
See also Leeward Islands.
Antimony in Canada, 57; New Brunswick, 57; New South Wales, 9, 16, 61; New Zealand, 33, 37, 73; Nova Scotia, 57; Quebec, 57; Queensland, 24, 31, 69; Sierra Leone, 85; South Australia, 67; Victoria, 17, 21, 65.
Apples in Canada, 129; Natal, 137; New Zealand, 133, 134; South Australia, 132; Victoria, 131.
Apricots in Queensland, 132; Victoria, 131; Western Australia, 133.
Arrack, method of manufacture of, 203.
Arsenic in New South Wales, 62; New Zealand, 74; Queensland, 69.
Asbestos in Canada, 2, 8; Cyprus, 53; New South Wales, 16, 61.
Ascension, volcanic specimens of, 80.
Assam, tea in, 149, 151, 164.
Australia, barks in, 395, 406; gums in, 252; hides in, 395; leather in, 391, 395; meat, frozen, from, 88, 89, 95; meat, tinned, from, 88; mutton, fresh, imports of, from, 91; mutton suet in, 253; sericiculture in, 362; tanning materials in, 392, 395, 406; raisins in, 253; skins, fur, in, 409; vinegar in, 253; waxes in, 252.
See also New South Wales, Queensland, South Australia, Victoria *and* Western Australia.

BAHAMAS, bark in, 251; cigars in, 247; cotton in, 299; fruits in, 143; salt in, 51, 258; timbers in, 457, 472.
Balata in British Guiana, 293.
Bananas in British Guiana, 140; British Honduras, 143; Ceylon, 137; Fiji, 135; Jamaica, 141, 142; Mauritius, 139; Queensland, 133.
Barbados, aloes in, 250; bean, caroub, in, 146; chemical products of, 258; coal in, 51; coral in, 51; cocoa in, 181; coffee in, 175; earth, infusorial, in, 51; fruits in, 146; manure, artificial, in, 51; petroleum in, 51; spirits in, 226; stone in, 51; sugar in, 188, 189; tar in, 296; timbers in, 455.
Barks, statistics relating to, 395.
—— in Australia, 395, 406; Bahamas, 251; British Guiana, 251, 256; Canada, 406; Cape of Good Hope, 255; Ceylon, 248; Dominica, 251; Fiji, 249; India, 404; Jamaica, 249, 251, 256; Montserrat, 251; New South Wales, 253; New Zealand, 406; Queensland, 254; St. Vincent, 257; Straits Settlements, 249; Victoria, 254; West Indian Islands, 251.
Barley in British Columbia, 110; Cape of Good Hope, 123; Manitoba, 109, 110; Natal, 123; New Brunswick, 102; New South Wales, 111, 112; New Zealand, 119, 121, 122; North-West Territories of Canada, 109, 110; Ontario, 103; Prince Edward Island, 101; Quebec, 102; Queensland, 117; South Australia, 117; Victoria, 113, 115.
Basils, *see* Leather.
Batavia, hides in, 396.
Bay Salt in Cyprus, 53.
Bean, caroub, in Cyprus, 146.
Beef, frozen, from New Zealand, 93; Johnson's fluid, 93; salt, from Western Australia, 95.
Beer, duties, 204; Lager, 205.
—— in Canada, 229; New South Wales, 205, 230; New Zealand, 205, 230; Queensland, 205, 230; South Australia, 205, 230; Victoria, 204, 229; Western Australia, 205, 230.
Beeswax, *see* Wax.
Berries (for medicinal purposes) in Cape of Good Hope, 255.
Beryls in Ceylon, 83; New South Wales, 63.

Bismuth in Canada, 58; New South Wales, 16, 62; Queensland, 69; South Australia, 67.
Bitters, Angostura, 202.
Boghead Mineral in New South Wales, 11, 13.
Boots and Shoes in Canada, 400; New South Wales, 401; New Zealand, 402; Queensland, 402; Victoria, 401; Western Australia, 402.
Brazil, cocoa in, 179; coffee in, 167.
Bread-fruit in Mauritius, 139.
British Columbia, barley in, 110; boots and shoes in, 401; fruit in, 130; garnets in, 58; gold in, 5, 56, 57; maize in, 111; mica in, 58; Mining Department of, 8; oats in, 110; pease in, 110; silver in, 56; soaps in, 276; timbers in, 412, 464; wheat in, 110.
See also Canada.
British Guiana, balata in, 293; barks in, 251, 256; chemical products of, 258; cocoa in, 178, 181; coffee in, 176; copaiba balsam in, 251; cotton in, 299; fibres in, 384; fruit in, 140; gold in, 84; gums in, 292, 295; gutta-percha in, 292; honey in, 253; india-rubber in, 295; oils in, 253, 268, 271, 274; pipe clay in, 84; quassia wood in, 251; rock specimens of, 84; silk in, 355; silkworms in, 355; spirits in, 201, 202, 224; sugar in, 188, 189; timbers in, 449; tobacco in, 246; vinegar in, 231, 253; wax, black, in, 295.
British Honduras, chemical products of, 258; cigars in, 247; coffee in, 176; cotton in, 299; fibres in, 384; fruit in, 143; gold in, 51; india-rubber in, 297; logwood in, 251; oils in, 269; pepper in, 252; sarsaparilla in, 250; silk in, 356; silkworms in, 356; spirits in, 202, 228; sugar in, 189; timbers in, 458, 472; tobacco in, 247.
British North Borneo, camphor in, 251; coal in, 49; fibres in, 385; gold in, 50; gums in, 291; gutta-percha in, 290, 291; india-rubber in, 290, 291; pepper in, 252; resins in, 291; silk in, 355; timbers in, 448, 471, 475; tobacco in, 246; waxes in, 252, 275.
Buchu Leaves in Cape of Good Hope, 250.
Bultfontein Diamond Mines, 39, 40, 75, 76.
Burma, timbers in, 463.
Butter, statistics relating to, 90.
—— in Canada, 86; Victoria, 94.

Cacao, *see* Cocoa.
Cachar, tea in, 149, 151, 164.
Calabar Beans in Ceylon, 251; West Africa, 251.
Camphor in British North Borneo, 251; Straits Settlements, 251.
Canada, agates in, 58; amethysts in, 58; antimony in, 57; asbestos in, 2, 8; beer in, 229; barks in, 406; bismuth in, 58; boots and shoes in, 400; butter in, 86; cattle in, 90, 93; cheese in, 87, 92; chemical industries of, 257; chlorastrolite in, 58; chrysotile in, 58; cigars in, 243; coal in, 2, 8; copper in, 4, 8, 56; felspar in, 58; fibres in, 369; fossils in, 59; fruit in, 129; garnets in, 58; Geological Survey of, 7, 55; gold in, 4, 8, 53, 56, 57; gums in, 283; gypsum in, 5, 8, 58; honey in, 252; hops in, 251; hornblende in, 58, india-rubber in, 283; iron in, 5, 8, 56; lead in, 5, 8, 57; leather in, 391, 396; lime, phosphate of, in, 6, 8, 58; machinery in, 476; magnesite in, 58; maize in, 99; manganese in, 8, 57; maple syrup in, 186; meat, tinned, in, 93; meneghinite in, 56; mica in, 6, 8, 58; minerals, statistics of, in, 8; molybdenite in, 58; musical instruments in, 491; oats in, 100; ochres in, 57; petroleum in, 6, 8, 279; pigs in, 90; plumbago in, 6; resins in, 283; rock crystals in, 58; rocks of, 59; saddlery and harness in, 403; salt in, 6, 8; sheep in, 90, 313; silk in, 331; silver in, 6, 8, 56; skins, fur, in, 407; slate in, 7, 8; soaps in, 276; spirits in, 203, 222; stone in, 7, 8; sugar in, 186, 188; talc in, 58; tanning materials in, 391, 406; tar in, 283; tellurium in, 58; timbers in, 412, 464, 475; tobacco in, 243; vine cultivation in, 200; vinegar in, 231; wheat in, 99; windmills in, 483; wines in, 200, 222; wools in, 313; zinc in, 57.
See also British Columbia, Manitoba, New Brunswick, North-West Territories, Nova Scotia, Ontario, Prince Edward Island, Quebec *and* Vancouver's Island.
Candles, 279.
Cape of Good Hope, aloes in, 250; barks in, 255; barley in, 123; berries (medicinal), 255; buchu leaves in, 250; caoutchouc, 289; cattle in, 90; chemical products of, 257; coal in, 38, 44; copper in, 38, 44; crocidolite in, 77; diamonds in, 39, 44, 75; fibres in, 377; fruits in, 135; goats in, 324, 326; gums in, 252, 255, 289; hides in, 395, 407; honey in, 253; hops in, 123, 251; leather in, 394; leaves (medicinal), 255; machinery in, 489; maize in, 123; minerals, statistics of, in, 40, 44; oats in, 123; oils (medicinal) in, 255; pigs in, 90; plants (medicinal), 255; raisins in, 253; resins in, 255; rock specimens of, 78; roots (medicinal), 255; rye in, 123; salt in, 44, 78, 258; senna in, 250; sheep in, 90; silk in, 346; silkworms in, 347; spirits in, 202,

223; stone in, 44; timbers in, 437, 470, 475; tobacco in, 244; vine cultivation in, 199; vinegar in, 253; waxes in, 255, 276; wheat in, 123; wines in, 199, 222; wools in, 323.
Cardamoms in Ceylon, 251; Grenada, 251; Jamaica, 251; Straits Settlements, 251.
Catechu in Straits Settlements, 251.
Cat's-eyes in Ceylon, 82.
Cattle, statistics relating to, 89, 90.
—— in Canada, 90, 93; Cape of Good Hope, 90; New South Wales, 89; New Zealand, 89; Queensland, 89, 90; South Australia, 89, 90; Tasmania, 89; Victoria, 89, 90; Western Australia, 89.
Celestite in Ontario, 58.
Ceylon, amethysts in, 83; barks in, 248; beryls in, 83; calabar beans in, 251; cardamoms in, 251; cat's-eyes in, 82; chrysoberyl in, 81; cigar in, 245; cinnamon in, 251; cloves in, 252; cocoa in, 182; coffee in, 167, 170; drugs (non-official) in, 256; fibres in, 384; fruit in, 137; gamboge in, 251; garnets in, 83; gems in, 46; moonstone in, 83; nutmegs in, 252; nux vomica seeds in, 250; oils in, 253, 267, 270, 272, 282; paddy in, 124; pickles in, 138; pimento in, 252; plumbago in, 47; rice in, 124; rubies in, 80; salt in, 258; sapphires in, 80; silk in, 349; silkworms in, 349; spinels in, 81; spirits in, 203, 224; stone in, 48; sugar in, 187, 189; tea in, 147, 148, 154; timbers in 441, 471; tobacco in, 245; topazes in, 83; tourmalines in, 83; zircons in, 82.
Cheese, statistics relating to, 90, 92.
—— in Canada, 87, 92; New Zealand, 93; Victoria, 94.
Chemical Industries, 257.
Cherries in Victoria, 131.
Chittagong, tea in, 149, 152, 164.
Chlorastrolite in Canada, 58.
Chota Nagpore, tea in, 149, 152, 164.
Chrome in Queensland, 69.
Chrysoberyl in Ceylon, 81.
Chrysotile in Canada, 58.
Cigars, double, 233; duty on, 239; manufacture of, 241; trade in, 238.
—— in Antigua, 246; Bahamas, 247; British Honduras, 247; Canada, 243; Ceylon, 245; Dominica, 247; India, 243; Jamaica, 246; Mauritius, 245; St. Lucia, 246; South Australia, 244; Straits Settlements, 245; Trinidad, 246; Victoria, 244.
Cigarettes, 243, 245.
Cinnabar in New South Wales, 62; New Zealand, 74; Queensland, 69,
Cinnamon in Ceylon, 251; Fiji, 251; St. Lucia, 251; Sierra Leone, 251; West Indian Islands, 251.
Citrons in Ceylon, 137.
Clay in Mauritius, 84; South Australia, 22; Victoria, 17.
Cloves in Ceylon, 252; Dominica, 252; St. Lucia, 252; Seychelles, 252.
Coal in Barbados, 51; British North Borneo, 49; Canada, 2, 8; Cape of Good Hope, 38, 44; Natal, 44; New South Wales, 9, 16; New Zealand, 33, 37; Queensland, 24, 31; Victoria, 17, 21.
Cobalt in New South Wales 61; Queensland, 69.
Cochin, oils in, 267.
Cocoa, preparation of, 178; statistics relating to, 178.
—— in Antigua, 181; Barbados, 181; Brazil, 179; British Guiana, 178, 181; Ceylon, 182; Dominica, 179, 180; Ecuador, 179; Grenada, 178, 180; Jamaica, 179, 181; Mauritius, 183; St. Lucia, 179, 180; St. Vincent, 181; Tobago, 181; Trinidad, 178, 179.
Cocoa-nuts in British Honduras, 143, 144; Ceylon, 137; Grenada, 144; Trinidad, 144.
Cocoons, laboratory examinations of, 331, 334, 337, 342, 348, 349, 359; value of, 339, 343.
Coffee, preparation of, 167; protection of, against fraud, 176; statistics relating to, 167, 170, 173.
—— in Andaman Islands, 173; Antigua, 174; Barbados, 175; Brazil, 167; British Guiana, 176; British Honduras, 176; Ceylon, 167, 170; Dominica, 175; Fiji, 172; Gold Coast, 173; Grenada, 175; India, 167, 168; Jamaica, 167, 173; Java, 167; Mauritius, 173; Montserrat, 175; Natal, 172; Nevis, 174; Queensland, 172; Perak, 171; St. Christopher, 174; St. Lucia, 175; Sierra Leone, 173; Straits Settlements, 171; Tobago, 175; Trinidad, 175.
Coorg, coffee in, 168.
Copaiba Balsam in British Guiana, 251.
Copper in Canada, 4, 8, 56; Cape of Good Hope, 38, 44; Cyprus, 52; New South Wales, 12, 60; New Zealand, 34, 73; Queensland, 26, 31, 69; South Australia, 22, 24, 66, 67; Victoria, 17, 21, 65; Western Australia, 31, 71.
Coral, uses of, in Barbados, 51.
Cordage, statistics relating to, 389.
Cotton, ginning, 301; history of, 299; oil, 302; seed-cake, 302; silk, 301.
—— in Bahamas, 299; British Guiana, 300; British Honduras, 299; Cyprus, 302; Dominica, 299; Fiji, 300; Gold Coast, 301; Malta, 303; Mauritius, 301; Natal, 301; Queensland, 301; St. Lucia, 299; St. Vincent, 299; South Australia, 301; Tobago, 299.
Crêpe in Cyprus, 358; Hong Kong, 353.

Crocidolite in Cape of Good Hope, 77.
Currants in Cape of Good Hope, 136; South Australia, 132; Western Australia, 133.
Cyprus, asbestos in, 53; bay salt in, 53; copper in, 52; cotton in, 299; crêpe in, 358; gums in, 298; gypsum in, 53; ochre in, 52; oils in, 274; silk in, 358; silkworms in, 358; soaps in, 277; spirits in, 229; timbers in, 461; umber in, 52; vine cultivation in, 201; vinegar in, 231, 253; wheat in, 102; wines in, 201, 221.
Cythéres in Mauritius, 139.

DAMASKS in Hong Kong, 353.
Dammar in Straits Settlements, 291.
Darjeeling, tea in, 149, 152, 164.
De Beer's Diamond Mines, 39, 40, 75.
Dehra Doon, tea in, 149, 153, 164.
Demerara, sugar in, 188.
Diamonds, statistics of mines, 40; washing, 41, 489.
—— in Cape of Good Hope, 39, 44, 75; New South Wales, 12, 16, 62; South Australia, 67.
Dominica, barks in, 251; chemical products of, 258; cigars in, 247; cloves in, 252; cocoa in, 179, 180; coffee in, 175; cotton in, 299; fruit in, 145; gums in, 297; lime juice in, 253; nutmegs in, 252; spirits in, 228; sugar in, 189; timbers in, 457.
See also Leeward Islands.
Dooras, tea in, 149, 152, 164.
Drugs, medicinal, in Trinidad, 257.
—— native, in Jamaica, 256; Straits Settlements, 256; West African Colonies, 257.
—— non-official, in Ceylon, 256.
Durian in Ceylon, 137.
Dutoitspan Diamond Mines, 39, 40, 76.

EARTH, infusorial, in Barbados, 51; Victoria, 65.
Ecuador, cocoa in, 179.
Engines, portable, 480.
"Extractum Carnis," 88.

FALKLAND ISLANDS, tallow in, 262.
Felspar in Canada, 58.
Fibres, analyses of, 366, 367, 368, 371, 372, 373, 376, 377, 378, 379, 380, 382, 383, 384; bleaching of, 386; classification of, 365; constituents of, 366; descriptions of, 365, 374; statistics relating to, 388; structure of, 366; supply of, 364; trade in, 387; treatment of, 374, 378, 385.
—— in British Guiana, 384; British Honduras, 384; British North Borneo, 385; Canada, 369; Cape of Good Hope, 377; Ceylon, 384; Fiji, 376; Gambia, 378; Gold Coast, 379; Mauritius, 385; Natal, 377, 389; New South Wales, 370; New Zealand, 373; Queensland, 372; St. Helena, 384; St. Vincent, 380; Sierra Leone, 379; South Australia, 370; Victoria, 371; West Indian Islands, 380, 389; Western Australia, 370.
Figs in Victoria, 131; Western Australia, 133.
Fiji, barks in, 249; chemical products of, 257; cinnamon in, 251; coffee in, 172; cotton in, 299; fibres in, 376; fruit in, 135; lime-juice in, 253; oils in, 253, 268, 270; silk in, 346; sugar in, 187, 188; tea in, 147, 148, 161; timbers in, 435; tobacco in, 244.
Flagging in Victoria, 21.
Flax in Manitoba, 110; North-West Territories of Canada, 110.
Flax-dressing, 385.
Food imported from British Possessions, quantity and value of, 91.
Fossils in Canada, 59; Natal, 79; New South Wales, 63; New Zealand, 74; Queensland, 70; South Australia, 68; Victoria, 66; Western Australia, 72.
Fruit, packing, 129, 132, 133, 141.
—— preserved, in British Guiana, 141; British Honduras, 144; Cape of Good Hope, 135; Fiji, 135; Jamaica, 141; Natal, 136; New Zealand, 134; Straits Settlements, 140; Tobago, 144; Western Australia, 133.
—— tinned, in Bahamas, 143; Straits Settlements, 140; Victoria, 131.
Fur Skins, *see* Skins, Fur.

GAMBIA, fibres in, 378; gums in, 298; oils in, 266; resins in, 298; silkworms in, 356; timbers in, 460.
See also West African Colonies.
Gamboge in Ceylon, 251; Singapore, 251.
Garnets in British Columbia, 58; Canada, 58; Ceylon, 83; New South Wales, 63.
Gems in Ceylon, 46; New South Wales, 12, 16.
Geological Survey of Canada, 7, 55.
Geology of Western Australia, 32.
Ginger in Gold Coast, 252; Sierra Leone, 252; Straits Settlements, 252; West Indian Islands, 252.
Glycerine, 265.
Goats, hair of, 308, 310, 324; horns of, 308.
—— in Cape of Good Hope, 324, 326; Western Australia, 321.
Gold, extracting apparatus, 487, 489; first discovery of, in Victoria, 17.
—— in British Guiana, 84, British Honduras, 51; British North Borneo, 49; Canada, 4, 8, 53, 56, 57; Gold Coast, 51, 85; Natal, 45; New South Wales,

12, 16, 59; New Zealand, 34, 37, 53, 72; Queensland, 26, 31, 53, 68, 487; South Australia, 23, 24, 53, 66; Transvaal, 79; Victoria, 17, 21, 53, 63; Western Australia, 31, 53, 71.
Gold Coast, coffee in, 173; cotton in, 299; fibres in, 379; ginger in, 252; gold in, 51, 81; gums in, 298; india-rubber in, 298.
See also West African Colonies.
Gold-size in New South Wales, 284.
Grain, statistics of, in Canada, 99, 126; India, 126; New South Wales, 111; New Zealand, 120; Queensland, 118; South Australia, 126; United Kingdom, 127, 128; Victoria, 126.
Grapes in Cape of Good Hope, 136; South Australia, 132; Victoria, 131.
Graphite in Queensland, 70.
Greenstone in New Zealand, 74.
Grenada, cardamoms in, 251; chemical products of, 258; cocoa in, 178, 180; coffee in, 175; fruit in, 144; gums in, 296; india-rubber in, 296; nutmegs in, 252; resins in, 297; timbers in, 445; tobacco in, 246.
Gums, statistics relating to, 288.
—— in British Guiana, 292, 295; British North Borneo, 291; Canada, 283; Cape of Good Hope, 252, 255, 289; Cyprus, 298; Dominica, 297; Gambia, 252, 298; Gold Coast, 252, 298; Grenada, 296; Jamaica, 252, 296; Lagos, 252, 298; New South Wales, 254, 283; New Zealand, 36, 37, 288; Queensland, 254, 284; St. Vincent, 297; Sierra Leone, 252, 297; South Australia, 252, 284; Tobago, 297; Trinidad, 252, 296; Victoria, 254, 284; Western Australia, 254, 286.
Gunpowder made in Australia, 21.
Gutta-percha, statistics relating to, 290.
—— in British Guiana, 292; British North Borneo, 290, 291; Straits Settlements, 290.
Guava-jelly in Bahamas, 143.
Gypsum in Canada, 5, 8, 58; Cyprus, 53.

HAIR, structure of, 309.
Harness, *see* Saddlery.
Hides, branding, 393; calf, 394, 395; cow, 395; enamelled, 394; flaying, 393; goat, 395; glove, 394; kangaroo, 393, 409; kid, 395; ox, 395; sheep, 394, 395, 396; statistics relating to, 395; Wallaby, 393, 409.
—— in Australia, 395; Batavia, 396; Cape of Good Hope, 395, 407; India, 396; Madagascar, 395; Manilla, 396; Mauritius, 395; Singapore, 396; West Indian Islands, 395.
Honey in British Guiana, 253; Canada, 252; Cape of Good Hope, 253; Malta, 253; New South Wales, 252; New Zealand, 252; Queensland, 252; South Australia, 252; Straits Settlements, 253; West Indian Islands, 253; Western Australia, 252.
Hong Kong, crêpe in, 353; damasks in, 353; sand in, 49; silk in, 351; silk-worms in, 352; spirits in, 224; stone in, 49; sugar in, 187, 189; timbers in, 447.
Hops in Canada, 251; Cape of Good Hope, 123, 251; New Zealand, 251; Victoria, 251.
Hornblende in Canada, 58; Mauritius, 84; Seychelles, 84.
Hudson's Bay Company, furs and skins of, 407, 411.
Hukahs, 234.

INDIA, barks in, 404; cigars in, 243; coffee in, 167, 168; hides in, 396; silk-reeling in, 343; sugar in, 185, 188; tanning materials in, 404; tea in, 147, 164; timbers in, 463, 475; tobacco in, 237, 240, 243; wheat in, 125, 126; wools in, 312.
India-rubber, statistics relating to, 290.
—— in British Guiana, 295; British Honduras, 297; British North Borneo, 290, 291; Canada, 283; Cape of Good Hope, 289; Gold Coast, 298; Grenada, 296; Sierra Leone, 297; Straits Settlements, 290.
Iron, chromic, in New South Wales, 62; New Zealand, 74.
—— tungstate of, in New South Wales, 62; Victoria, 65.
—— in Canada, 5, 8, 56; Natal, 46, 79; New South Wales, 13, 16, 60; New Zealand, 36, 37, 73; Nova Scotia, 57; Queensland, 29, 69; Sierra Leone, 84; South Australia, 23, 67; Victoria, 20, 21, 65; Western Australia, 32, 71.
Ironstone in Straits Settlements, 84.

JALAP ROOT in Jamaica, 250.
Jamaica, barks in, 249, 251, 256; cardamoms in, 251; chemical products of, 258; cigars in, 246; cocoa in, 179, 181; coffee in, 167, 173; drugs (native) in, 256; fibres in, 381, 383; fruit in, 141; gums in, 296; nutmegs in, 252; oils in, 271; oils (for perfumes) in, 259; pimento in, 252; quassia wood in, 251; roots (medicinal) in, 250, 257; sarsaparilla in, 250; spirits in, 201, 224; sugar in, 189; tea in, 148, 162; timbers in, 454.
See also West Indies.
Jams in Ceylon, 138; Mauritius 139; New Zealand, 134.
Java, coffee in, 167.
"Johnson's fluid beef," 93.
Johore, tea in, 147, 148, 163.

KANGRA VALLEY, tea in, 149, 153, 164.
Kaolin in Victoria, 65.
Kerosene-shale in New South Wales, 61.
Kimberley Diamond Mines, 39, 40, 75, 77; Gold Fields, 71.
Kumaon, tea in, 149, 153, 164.

LAC in Straits Settlements, 291.
Lace in Malta, 357.
Lacquers in New South Wales, 284.
Lagos, gums in, 298; leather in, 396; oils in, 265; timbers in, 460.
See also West African Colonies.
Lava in St. Helena, 79.
Lead in Canada, 5, 8, 57; New South Wales, 13, 61; New Zealand, 73; Queensland, 29, 31, 69; South Australia, 24, 66; Victoria, 20, 21, 64; Western Australia, 32, 71.
Leather, basils, 394, 395; harness, 394, 395; methods of preparing, 391; morocco, 395; sole, 391, 392, 394; statistics relating to, 395; strap, 365; upper, 393.
—— in Australia, 391, 395; Canada, 391, 326; Cape of Good Hope, 394; Lagos, 396; Natal, 395; New South Wales, 392, 396; New Zealand, 391, 400; Queensland, 399; Victoria, 392, 398; Western Australia, 399.
Leaves (flavouring) in St. Vincent, 257; (medicinal) in Cape of Good Hope, 255.
Leeward Islands, lime, phosphate of, in, 51; sulphur in, 51.
See also Antigua, Dominica, Montserrat, Nevis *and* St. Christopher.
Lemons in New Zealand, 133.
"Liebig's Extract of Meat," 88.
Lignite in Western Australia, 71.
Lime, phosphate of, in Canada, 6, 8, 58; Leeward Islands, 51.
—— tungstate of, in Victoria, 65.
Lime-juice in Dominica, 253; Fiji, 253; Montserrat, 253; Natal, 253; Trinidad, 258; West Indian Islands, 253.
Limes in British Honduras, 143; Dominica, 145; Jamaica, 142; Montserrat, 145; New Zealand, 133.
Limestone in Natal, 79.
Linen, statistics relating to, 389.
Logwood in British Honduras, 251.

MACHINERY, agricultural, 115, 476, 484, 485; diamond-washing, 489; gold-extracting, 487, 489; metal-working, 482; wood-working, 481.
—— in Canada, 476; Cape of Good Hope, 489; New Zealand, 489; Queensland, 489; South Australia, 115, 485; Victoria, 484.
Madagascar, hides in, 395.
Magnesite in Canada, 58.
Maize in Canada, 99; Cape of Good Hope, 123; Natal, 123; New South Wales, 111, 112; Queensland, 117, 118; South Australia, 117; Victoria, 115; Western Australia, 119.
Malay States, spirits in, 229.
Malta, cotton in, 299; honey in, 253; lace in, 357; silk in, 357; stone in, 52; timbers in, 461; tobacco in, 247.
Manganese in Canada, 8, 57; New South Wales, 61; New Zealand, 36, 73; Queensland, 69; South Australia, 24, 67; Victoria, 65.
Mangoes in British Honduras, 143; Ceylon, 137; Jamaica, 142; Queensland, 133.
Mangosteen in Ceylon, 137; Straits Settlements, 140.
Manilla, hides in, 396.
Manitoba, barley in, 109, 110; cattle in, 90; flax in, 110; oats in, 109, 110; pigs in, 90; prairie-fires in, 107; prairie-grass in, 105, 106; settlers in, 106; sheep in, 90; weeds in, 107; wheat in, 107, 108, 110; wools in, 313.
See also Canada.
Manure, artificial, in Barbados, 51.
Maple Syrup in Canada, 186.
Mauritius, amethysts in, 84; cigars in, 245; clay in, 84; cocoa in, 183; coffee in, 173; cotton in, 299; fibres in, 385; fruit in, 139; hides in, 395; hornblende in, 84; mica in, 84; oils in, 268, 281, 282; soaps in, 268; spirits in, 202, 228; stone in, 48; sugar in, 187, 189; timbers in, 444; tobacco in, 245; vinegar in, 231.
Meat, chilled, from United States, 89.
—— frozen, from Australia, 88, 89, 95; New Zealand, 88, 89; Queensland, 95.
—— preserved, from South Australia, 95; Victoria, 94.
—— tinned, from Australia, 88; Canada, 93; New Zealand, 88, 94; United States, 88.
Melons in Victoria, 131.
Meneghinite in Canada, 56.
Mercury in New South Wales, 62.
Mica in Canada, 6, 8, 58; Mauritius, 84; Seychelles, 84.
Milk, condensed, in Nova Scotia, 92.
Minerals, statistics of, in Canada, 8; Cape of Good Hope, 40, 44; New South Wales, 16; New Zealand, 37; Queensland, 31; South Australia, 24; Victoria, 21.
Mines, Departments of, New South Wales, 9, 16; Victoria, 21.
Moa, extinct bird of New Zealand, 74.
Molybdenite in Canada, 58; New South Wales, 62; Queensland, 69; South Australia, 67.
Montserrat, barks in, 251; chemical products of, 258; coffee in, 175; fruit in,

145; lime-juice in, 253; sarsaparilla in, 250; spirits in, 228; sugar in, 189; timbers in, 457.
See also Leeward Islands.
Moonstones in Ceylon, 83.
Mulberry-tree in its relation to sericiculture, 339.
Musical Instruments in Canada, 491.
Mutton, fresh, imports of, from Australasia, 91.
—— frozen, from New Zealand, 93.
—— suet in Australia, 253.
Mysore, coffee in, 168.

NATAL, aloes in, 250; barley in, 124; chemical products of, 257; coal in, 44; coffee in, 172; cotton in, 299; fibres in, 377, 389; fossils in, 79; fruit in, 136; gold in, 45; iron in, 46, 79; leather in, 395; lime-juice in, 253; limestone in, 79; maize in, 123; oats in, 124; ochre in, 79; oils in, 273; plumbago in, 46; rice in, 124; roots (for killing fish) in, 256; silk in, 348; sorghum in, 124; spirits in, 228, 253; stone in, 46; sugar in, 186, 188; tea in, 147, 148, 161; timbers in, 439; tobacco in, 245; umber in, 79; wheat in, 123; wools in, 326.
Neilgherry, coffee in, 168; tea in, 149, 153, 164.
Nevis, coffee in, 174; spirits in, 228.
See also Leeward Islands.
New Brunswick, antimony in, 57; barley in, 102; cattle in, 90; coal in, 3; manganese in, 57; oats in, 101; pigs in, 90; sheep in, 90; silk in, 332; timbers in, 101, 412, 465; wheat in, 101.
See also Canada.
New South Wales, antimony in, 9, 16, 61; arsenic in, 62; asbestos in, 16, 61; barks in, 253; barley in, 111, 112; beer in, 205, 230; beryls in, 63; bismuth in, 16, 62; boghead mineral in, 11, 13; boots and shoes in, 401; cattle in, 89; chemical industries of, 257; cinnabar in, 62; coal in, 9, 16; cobalt in, 61; copper in, 12, 16, 60; diamonds in, 12, 16, 62; fibres in, 370; fossils in, 63; fruit in, 130; garnets in, 63; gems in, 12, 16; gold in, 12, 16, 53, 59; gold-size in, 284; gums in, 254, 283; honey in, 252; iron in, 13, 16, 60; iron, chromic, in, 62; iron, tungstate of, in, 62; kerosene-shale, 61; lacquers in, 284; lead in, 13, 61; leather in, 392, 396; maize in, 111, 112; manganese in, 61; mercury in, 62; minerals, statistics of, 16; Mines, Department of, of, 9, 16; molybdenite in, 62; oats in, 111, 112; oil-shale in, 11, 13, 16; oils in, 253, 263, 264, 273; oils (for perfumes) in, 254; osmiridium in, 62; pigs in, 89; quicksilver in, 13; resins in, 283; rock crystals in, 61; rock specimens of, 63; saddlery and harness in, 403; sapphires in, 63; sarsaparilla in, 250; sheep in, 89, 90; shellac in, 284; silk in, 334; silkworms in, 334; silver in, 13, 16, 60; soaps in, 277; spirits in, 222; stone in, 15; sugar in, 186, 188; tallow in, 262; timbers in, 415, 465, 474; tin in, 15, 16, 53, 60; tobacco in, 243; topazes in, 63; vine cultivation in, 193; vinegar in, 231, 253; wages in, 112; waxes in, 252, 284; wheat in, 111; wines in, 193, 206; wolfram in, 62; wools in, 313, 328; zinc in, 51; zinc, tungstate of, in, 62; zircons in, 63.
See also Australia.
New Zealand, antimony in, 33, 37, 73; arsenic in, 74; barks in, 406; barley in, 119, 121, 122; beer in, 205, 230; boots and shoes in, 402; cattle in, 89; cheese in, 93; chemical products of, 257; cinnabar in, 74; coal in, 33, 37; copper in, 34, 73; fibres in, 373; fossils in, 74; fruit in, 133; fruit-wines in, 206; gold in, 34, 37, 53, 72; greenstone in, 74; gums in, 36, 37, 288; honey in, 252; hops, in, 251; iron in, 36, 37, 73; iron, chromic, in, 74; lead in, 73; leather in, 391, 400; machinery in, 489; manganese in, 36, 73; meat, frozen, from, 88, 89, 93; meat, tinned, from, 88, 94; minerals, statistics of, in, 37; moa, extinct bird of, 74; oats in, 119, 121, 122; pharmaceutical products of, 259; pigs in, 89; rock specimens of, 74; saddlery and harness in, 403; schorl in, 74; sheep in, 89, 90, 92, 322; silk in, 346; silkworms in, 346; silver in, 36, 37, 73; soaps in, 277; soils of, 119; spirits in, 223; stone in, 36; tallow in, 262; tanning materials in, 392, 406; timbers in, 433, 469, 474; vinegar in, 231; wheat in, 119, 120, 122; wines in, 199, 220; wools in, 322; zinc in, 73.
North-West Territories of Canada, barley in, 109, 110; coal in, 3; flax in, 110; oats in, 109, 110; prairie-fires in, 107; prairie-grass in, 105, 106; settlers in, 106; timbers in, 412; weeds in, 107; wheat in, 107, 108, 110, 125, 126.
See also Canada.
Nova Scotia, antimony in, 57; cattle in, 90; coal in, 2; gold in, 4; gypsum in, 58; iron in, 57; manganese in, 57; milk (condensed) in, 92; Mining Department of, 8; oats in, 100; pigs in, 90; sheep in, 90; silk in, 332; timbers in, 412, 464; wheat in, 100, 101.
See also Canada.
Nutmegs in Ceylon, 252; Dominica, 252;

Grenada, 252; Jamaica, 252; St. Lucia, 252; St. Vincent, 252.
Nux Vomica Seeds in Ceylon, 250; Trinidad, 250.

OATS in British Columbia, 110; Cape of Good Hope, 123; Manitoba, 109, 110; Natal, 124; New Brunswick, 101; New South Wales, 111, 112; New Zealand, 119, 121, 122; North-West Territories of Canada, 109, 110; Ontario, 103; Prince Edward Island, 101; Quebec, 102; Queensland, 117, 118; Victoria, 113, 115; Western Australia, 119.
Ochres in Canada, 57; Cyprus, 52; Natal, 79.
Oil-shale in New South Wales, 11, 13, 16.
Oils, bassia, 272; Behen, 271; cahoon, 269; candle-nut, 269; cashew-nut, 272; castor, 253, 270; Ceylon, 267, 281, 282; Cochin, 269, 281, 282; cocoa-nut, 266, 268, 269, 281; copra, 267, 268, 281; cotton, 302; crab, 274; dolphin, 263; dugong, 263; emu, 263; essential, 254; fish, 263, 264; ground-nut, 273, 281; grugru, 269; kerosene, 257; lard, 263; margosa, 272; medicinal, 253, 254, 264, 270; mineral, 279; mustard, 272; neat's-foot, 263; olive, 253, 273; palm, 265, 266, 280; for perfumes, 254, 259; Poonac, 267; porpoise, 263, 264; punnai, 272; seal, 263; shark, 264; sperm, 263; statistics relating to, 265, 267, 280, 281, 282; sunflower-seed, 273; trotter, 263; vegetable, 254, 255; whale, 263, 264.
—— in British Guiana, 253, 268, 271, 274; British Honduras, 269; Canada, 263, 279; Cape of Good Hope, 255; Ceylon, 253, 267, 270, 272, 282; Cochin, 267; Cyprus, 274; Fiji, 253, 268, 270; Gambia, 266; Jamaica, 259, 271; Lagos, 265; Mauritius, 268, 281, 282; Natal, 273; New South Wales, 253, 254, 263, 264, 273; Queensland, 254, 263, 264, 270; St. Lucia, 264, 268; St. Vincent, 264, 268, 269; Seychelles, 253; South Australia, 253, 273; Straits Settlements, 268; Tobago, 268, 269, 274; Trinidad, 268, 271; Victoria, 253, 254; West Indian Islands, 253; Western Australia, 253, 263, 264, 273.
Olives in Western Australia, 133.
Ontario, barley in, 103; bismuth in, 58; boots and shoes in, 401; butter in, 86; celestite in, 58; cheese in, 87, 92; fruits in, 130; honey in, 252; maize in, 103; molybdenite in, 58; oats in, 103; oils in, 279; pease in, 103; petroleum in, 279; silk in, 332; soaps in, 276; timbers in, 104, 464; wheat in, 102.
See also Canada.
Opals in Queensland, 70.
Opium in Victoria, 250.
Oranges in British Honduras, 143, 144; Ceylon, 137; Jamaica, 141, 142; Natal, 136; New South Wales, 130; Queensland, 132.
Organs in Canada, 491.
Osmiridium in New South Wales, 62.

PADDY in Ceylon, 124.
Paper, manufacture of, 371, 379, 385, 389; statistics relating to, 389.
Paraffin, 279.
Peaches in Mauritius, 139; Natal, 136; Queensland, 132; Victoria, 131; Western Australia, 133.
Pears in British Columbia, 130; British Honduras, 133; Mauritius, 139; New Zealand, 133; South Australia, 132, Western Australia, 133.
Pease in British Columbia, 110; Ontario, 103.
Pepper in British Honduras, 252; British North Borneo, 252; Straits Settlements, 252; West Indian Islands, 252.
Perak, coffee in, 171; tin in, 48.
Persimmon in Victoria, 131.
Petroleum in Barbados, 51; Canada, 6, 8, 279.
Pharmaceutical Products of New Zealand, 259; Queensland, 259; Victoria, 259.
Pianofortes in Canada, 491, 492.
Pickles in Ceylon, 138.
Pigs, statistics relating to, 89, 90.
—— in Canada, 90; Cape of Good Hope, 90; New South Wales, 89; New Zealand, 89; Queensland, 89; South Australia, 89; Tasmania, 89; Victoria, 89; Western Australia, 89.
Pimento in Ceylon, 252; Jamaica, 252; St. Lucia, 252.
Pine-apples in Antigua, 145; Bahamas, 143; British Honduras, 143, 144; Ceylon, 137; Fiji, 135; Grenada, 144; Jamaica, 142; Mauritius, 139; Queensland, 133; Straits Settlements, 140.
Pipe-clay in British Guiana, 84.
Pipes, 233.
Pitch in Trinidad, 50.
Plantains in Ceylon, 138; Grenada, 144.
Plants (for medicinal purposes) in Cape of Good Hope, 255.
Plumbago, uses of, 47.
—— in Canada, 6; Ceylon, 47; Natal, 46; South Australia, 67.
Plums in Victoria, 131.
Pomegranates in Cyprus, 146.
Potatoes in South Australia, 116; Victoria, 115.
Prairie-fires in Manitoba, 107; North-West Territories of Canada, 107.
Prairie-grass in Manitoba, 105, 106; North-West Territories of Canada, 105, 106.

Prince Edward Island, barley, 101; maize, 101; oats, 101; silk in, 333; wheat, 131.
See also Canada.

QUARTZ-CRUSHING in Queensland, 28, 487.
Quassia Wood in British Guiana, 251; Jamaica, 251; St. Vincent, 251; Tobago, 251.
Quebec, antimony in, 57; asbestos in, 2; barley in, 102; boots and shoes in, 400; cattle in, 90; cheese in, 87, 92; gold in, 4; manganese in, 57; mica in, 6; oats in, 102; oils in, 263; pigs in, 90; sheep in, 90; silk in, 331; soaps in, 276; timbers in, 464.
See also Canada.
Queensland, antimony in, 24, 31, 69; arsenic in, 69; barks in, 254; barley in, 117; beer in, 205, 230; bismuth in, 69; boots and shoes in, 402; cattle in, 89, 90; chemical products of, 257; chrome in, 69; cinnabar in, 69; coal in, 24, 31; cobalt in, 69; coffee in, 172; copper in, 26, 31, 69; cotton in, 299; fibres in, 372; fossils in, 70; fruit in, 132; gold in, 26, 31, 53, 68; graphite in, 70; gums in, 254, 284; honey in, 252; iron in, 29, 69; lead in, 29, 31, 69; leather in, 399; machinery in, 487; maize in, 117, 118; manganese in, 69; meat, frozen, from, 95; minerals, statistics of, in, 31; molybdenite in, 69; oats in, 117, 118; oils in, 263, 264, 270; oils (medicinal) in, 254, 264; oils (for perfumes) in, 254; opals in, 70; pharmaceutical products of, 259; pigs in, 89; quartz-crushing in, 28, 487; quicksilver in, 29; resins in, 255, 284; rice in, 118; rock specimens of, 70; saddlery and harness in, 403; sheep in, 89, 90; silk in, 344; silk-worms in, 344; silver in, 29, 31, 68; soaps in, 277; spirits in, 203, 223; stone in, 29; sugar in, 186, 188; tallow in, 262; timbers in, 423, 467, 474; tin in, 30, 31, 53, 69; tobacco in, 244; vinegar in, 231; wheat in, 117, 118; wines in, 199, 219; wolfram in, 69; wools in, 320.
See also Australia.
Quicksilver in New South Wales, 13.
Quinces in New Zealand, 133.

RAISINS in Australia, 253; Cape of Good Hope, 136, 253; South Australia, 132; Western Australia, 133.
Raspberries in Victoria, 132.
Resins in Antigua, 297; British North Borneo, 291; Canada, 283; Cape of Good Hope, 255; Gambia, 298; Grenada, 297; New South Wales, 283; Queensland, 254, 284; St. Lucia, 297; Victoria, 283; Western Australia, 286.
Rice in Ceylon, 124; Natal, 124; Queensland, 118.
Rock Crystals in Canada, 58; New South Wales, 61; Victoria, 65.
Rock Specimens of British Guiana, 84; Canada, 59; Cape of Good Hope, 78; New South Wales, 63; New Zealand, 74; Queensland, 70; South Australia, 67; Victoria, 66; Western Australia, 72.
Roots (for killing fish) in Natal, 256; Straits Settlements, 256.
—— (medicinal) in Cape of Good Hope, 255; Jamaica, 257; Trinidad, 257.
Rubies in Ceylon, 80.
Rye in Cape of Good Hope, 123.

SADDLERY AND HARNESS in Canada, 403; New South Wales, 403; New Zealand, 403; Queensland, 403; South Australia, 402, 403; Victoria, 402, 403; Western Australia, 403.
St. Christopher, coffee in, 174; spirits in, 228; sugar in, 189; timbers in, 456.
See also Leeward Islands.
St. Helena, fibres in, 384; lava in, 79.
St. Kitts, *see* St. Christopher.
St. Lucia, chemical products of, 258; cigars in, 246; cinnamon in, 251; cloves in, 252; cocoa in, 179, 180; coffee in, 175; cotton in, 299; fruit in, 145; nutmegs in, 252; oils in, 264, 268; pimento in, 252; resins in, 297; spirits in, 227; sugar in, 189; timbers in, 456; tobacco in, 246.
St. Vincent, barks in, 257; chemical products of, 258; cocoa in, 181; cotton in, 299; fibres in, 380; gums in, 297; leaves for flavouring in, 257; nutmegs in, 252; oils in, 264, 268, 269; quassia wood in, 251; sarsaparilla in, 250; spirits in, 227; sugar in, 189; timbers in, 445.
Salt in Bahamas, 51, 258; Canada, 6, 8; Cape of Good Hope, 44, 78, 258; Ceylon, 258.
Sand in Hong Kong, 49.
Sapphires in Ceylon, 80; New South Wales, 63.
Sarsaparilla in British Honduras, 250; Jamaica, 250; Montserrat, 250; New South Wales, 250; St. Vincent, 250; Tobago, 250; Trinidad, 250; Western Australia, 250, 254.
Satin in Western Australia, 345.
Schorl in New Zealand, 74.
Senna in Cape of Good Hope, 250.
Sericiculture, *see* Silk.
Settlers in Manitoba, 106; North-West Territories of Canada, 106.
Seychelles, cloves in, 252; hornblende in, 84; mica in, 84; oils in, 253; timbers in, 445.

Sheep, cultivation of, 327; horns of, 308; origin, place of, 307; primitive, 307; statistics relating to, 89, 90, 313, 314, 321; wool of, 309.
—— in Canada, 90, 313; Cape of Good Hope, 90; New South Wales, 89, 90; New Zealand, 89, 90, 92, 322; Queensland, 89, 90; South Australia, 89; Tasmania, 89; Victoria, 89, 90, 94; Western Australia, 89, 90.
Shellac in New South Wales, 284.
Sierra Leone, antimony in, 85; cinnamon in, 251; coffee in, 173; fibres in, 379; ginger in, 252; gums in, 297; india-rubber in, 297; iron in, 84; oils in, 297; timbers in, 460; waxes in, 297.
See also West African Colonies.
Silk, culture, profits of, 339; dyeing, 354; looms, 358; nomenclature of, 352; reeling, 330, 341, 343, 344, 346, 352, 358; statistics relating to, 330.
—— in Australia, 362; British Guiana, 355; British Honduras, 356; British North Borneo, 355; Canada, 331; Cape of Good Hope, 346; Ceylon, 349; Cyprus, 358; Fiji, 346; Hong Kong, 351; Malta, 357; Natal, 348; New Brunswick, 332; New South Wales, 334; New Zealand, 346; Queensland, 344; South Australia, 341; Straits Settlements, 351; Victoria, 337; West Indian Islands, 355; Western Australia, 345.
Silkworms, directions for collecting, 363; eggs of, 333, 334, 337, 339, 343, 362; hatching of, 337; natural history of, 337; rearing of, 362; Tussur, 338, 352.
—— in British Guiana, 355; British Honduras, 356; Cape of Good Hope, 347; Ceylon, 349; Cyprus, 358; Gambia, 356; Hong Kong, 352; New South Wales, 334; New Zealand, 346; Queensland, 344; Victoria, 338; Western Australia, 345.
Silver in Canada, 6, 8, 56; New South Wales, 13, 16, 59; New Zealand, 36, 37, 73; Queensland, 29, 31, 68; South Australia, 66; Victoria, 20, 21, 64.
Singapore, gamboge in, 251; hides in, 396; tanning materials in, 404.
See also Straits Settlements.
Skins, *see* Hides.
—— fur, statistics relating to, 410; uses of, 408.
—— in Australia, 409; Canada, 407; United States, 411.
Slate in Canada, 7, 18; Victoria, 21.
Snuff, 243.
Soaps, analyses of, 278.
—— in Canada, 276; Cyprus, 277; Mauritius, 268; New South Wales, 277; New Zealand, 277; Queensland, 277; Straits Settlements, 277; Trinidad, 277; Victoria, 277.
Soils of New Zealand, 119.
Sorghum in Natal, 124.
South Australia, antimony in, 67; barley in, 117; beer in, 205, 230; bismuth in, 67; cattle in, 89, 90; chemical products of, 257; cigars in, 244; clay in, 22, copper in, 22, 24, 66, 67; cotton in; 299; diamonds in, 67; fibres in, 370; fossils in, 68; fruit in, 132; gold in, 23, 24, 53, 66; gums in, 252, 284; honey in, 252; iron in, 23, 67; lead in, 24, 66; machinery in, 115; maize in, 117; manganese, 24, 67; meat, preserved, in, 95; minerals, statistics of, of, 24; molybdenite in, 67; oils in, 253, 273; pigs in, 89; plumbago in, 67; potatoes in, 116; rock specimens of, 67; saddlery and harness in, 402, 403; sheep in, 89; silk in, 341; silver in, 66; spirits in, 222, 253; stone in, 24; tallow in, 262; tobacco in, 244; timbers in, 421, 467, 474; tin in, 24, 53, 67; vine cultivation in, 194; vinegar in, 231, 253; wheat in, 115, 116, 125, 126; wines in, 194, 213; wools in, 318, 328; zinc in, 24, 67.
See also Australia.
Spinels in Ceylon, 81.
Spirits, fermentation of, 202.
—— in Antigua, 228; Barbados, 226; British Guiana, 201, 202, 224; British Honduras, 202, 228; Canada, 203, 222; Cape of Good Hope, 200, 223; Ceylon, 203, 224; Cyprus, 229; Dominica, 228; Hong Kong, 224; Jamaica, 201, 224; Malay States, 229; Mauritius, 202, 228; Montserrat, 228; Natal, 228, 253; Nevis, 228; New South Wales, 292; New Zealand, 223; Queensland, 203, 223; St. Christopher, 228; St. Lucia, 227; St. Vincent, 227; South Australia, 222, 253; Tobago, 202, 227; Trinidad, 202, 226; Victoria, 223; Western Australia, 223.
Statistics, *see* Barks, Butter, Cattle, Cheese, Cocoa, Coffee, Cordage, Diamonds, Fibres, Fur Skins, Grain, Gums, Gutta-percha, Hides, India-rubber, Leather, Linen, Minerals, Oils, Paper, Pigs, Sheep, Silk, Sugar, Tallow, Tanning Materials, Tea, Tobacco *and* Wools.
Stone in Barbados, 51; Canada, 7, 8; Cape of Good Hope, 44; Ceylon, 48; Hong Kong, 49; Malta, 52; Mauritius, 48; Natal, 46; New South Wales, 15; New Zealand, 36; Queensland, 29; South Australia, 24; Victoria, 20; Western Australia, 32.
Straits Settlements, barks in, 249; camphor in, 251; caoutchouc in, 291;

cardamoms in, 251; catechu in, 251; cigars in, 245; coffee in, 171; dammar in, 291; drugs (native) in, 256; fruit in, 139; ginger in, 252; gutta-percha in, 290; honey in, 253; india-rubber in, 290; ironstone in, 84; lac in, 291; oils in, 268; pepper in, 252; roots (for killing fish) in, 256; silk in, 351; soaps in, 277; tobacco in, 245; timbers in, 446; tin in, 48, 84.
See also Singapore.
Strawberries in Mauritius, 139; Victoria, 132.
Sugar, analyses of, 190; exhibits, classification of, 188; industry, outline of, 184; statistics relating to, 184.
—— in Antigua, 189; Barbados, 188, 189; British Guiana, 188, 189; British Honduras, 189; Canada, 186, 188; Ceylon, 187, 189; Demerara, 188; Dominica, 189; Fiji, 187, 188; Hong Kong, 187, 189; India, 185, 188; Jamaica, 189; Mauritius, 187, 189; Montserrat, 189; Natal, 186, 188; New South Wales, 186, 188; Queensland, 186, 188; St. Christopher, 189; St. Lucia, 189; St. Vincent, 189; Tobago, 189; Trinidad, 188, 189.
Sulphur in Leeward Islands, 51.
Sylhet, tea in, 149, 151, 164.

TALC in Canada, 58.
Tallow, statistics relating to, 261, 280; vegetable, 274.
—— in Falkland Islands, 262; New South Wales, 262; New Zealand, 262; Queensland, 262; South Australia, 262; Victoria, 262.
Tamarinds in Barbados, 146; British Honduras, 143, 144; Montserrat, 145.
Tanning Materials, statistics relating to, 395, 404.
—— in Australia, 392, 395, 406; Canada, 391, 406; India, 404; New Zealand, 392, 406; Singapore, 404.
Tar in Barbados, 296; Canada, 283.
Tasmania, cattle in, 89; pigs in, 89; sheep in, 89; wools in, 327.
Tea, analyses of, 158; blending, 150; companies registered in London, 166; consumption of, in Great Britain, 150, 164; cost of production, 154; enemies, 157; exhibition awards for, 150; origin of, in Ceylon, 154, and India, 149; packing, 154; sale of, at Colonial Exhibition, 148, 152; statistics relating to, 147, 148, 149, 153, 160, 164, 166; yield per acre, 154, 158.
—— in Andaman Islands, 149; Assam, 149, 151, 164; Cachar, 149, 151, 164; Ceylon, 147, 148, 154; Chota Nagpore, 149, 152, 164; Chittagong, 149, 152, 164; Darjeeling, 149, 152, 164; Dehra Doon, 149, 153, 164; Dooars, 149, 152, 164; Fiji, 147, 148, 161; India, 147, 164; Jamaica, 148, 162; Johore, 147, 148, 163; Kangra Valley, 149, 153, 164; Kumaon, 149, 153, 164; Natal, 147, 148, 160; Neilgherry, 149, 153, 164; Sylhet, 149, 151, 164; Terai, 149, 152; Travancore, 153.
Terai, tea in, 149, 152.
Tellurium in Canada, 58.
Timbers, dried by cool-air process, 474; tests of, 462.
—— in Andaman Islands, 463; Anticosti, 412; Antigua, 456; Bahamas, 457, 472; Barbados, 455; British Columbia, 412, 464; British Guiana, 449; British Honduras, 458, 472; British North Borneo, 448, 471, 475; Burma, 463; Canada, 101, 412, 464, 475; Cape of Good Hope, 437, 470, 475; Ceylon, 441, 471; Cyprus, 461; Dominica, 457; Fiji, 435; Gambia, 460; Grenada, 455; Hong Kong, 447; Jamaica, 454; India, 463, 475; Lagos, 460; Malta, 461; Mauritius, 444; Montserrat, 457; Natal, 439; New Brunswick, 101, 412, 464; New South Wales, 415, 465, 474; New Zealand, 433, 469, 474; North-West Territories of Canada, 412; Ontario, 104, 464; Quebec, 464; Queensland, 423, 467, 474; St. Christopher, 456; St. Lucia, 456; St. Vincent, 455; Seychelles, 445; Sierra Leone, 460; South Australia, 421, 467, 474; Straits Settlements, 446; Tobago, 456; Trinidad, 454; Victoria, 419, 466, 474; Western Australia, 430, 468, 474.
Tin in Perak, 48; Queensland, 30, 31, 53, 69; New South Wales, 15, 16, 60; South Australia, 24, 53, 67; Straits Settlements, 48, 84; Victoria, 20, 21, 53, 64.
Tobacco, chemistry of, 239; cultivation of, 236, 240, 247; duty on, 236; history of, 233; manufacture of, 240; plants, description of, 237; statistics relating to, 236, 238; trade in, 238.
—— in Antigua, 246; British Guiana, 246; British Honduras, 247; British North Borneo, 246; Canada, 243; Cape of Good Hope, 244; Ceylon, 245; Fiji, 244; Grenada, 246; India, 237, 240, 243; Malta, 247; Mauritius, 245; Natal, 245; Queensland, 244; New South Wales, 243; St. Lucia, 246; South Australia, 244; Straits Settlements, 245; Trinidad, 246; Victoria, 244; Western Australia, 237.
Tobago, chemical products of, 258; cocoa in, 181; coffee in, 175; cotton in, 299; fruit in, 144; gums in, 297; oils in, 268, 269, 274; quassia wood in, 251;

sarsaparilla in, 250; spirits in, 202, 227; sugar in, 189; timbers in, 456.
Tools, metal-working, 482.
Topazes in Ceylon, 83; New South Wales, 63.
Tourmalines in Ceylon, 83.
Transvaal, gold in, 79.
Travancore, coffee in, 168, 170; tea in, 153.
Trinidad, angostura bitters in, 202; chemical products of, 258; cigars in, 246; cocoa in, 178, 179; coffee in, 175; drugs (medicinal) in, 257; fibres in, 381; fruit in, 144; gums in, 296; lime-juice in, 258; nux vomica seeds in, 250; oils in, 268, 271; pitch in, 50; roots (medicinal) in, 257; sarsaparilla in, 250; soaps in, 277; spirits in, 202, 226; sugar in, 188, 189; timbers in, 454; tobacco in, 246.
See also West Indies.

UMBER in Cyprus, 52; Natal, 79.
United Kingdom, food imported from British Possessions, quantity and value of, 91; grain imports to, statistics of, 127; stock, census of, in, 89; wheat, cost of production, in, 126.
United States, meat, chilled, from, 89; meat, tinned, from, 88; skins, fur, in, 411.

VANCOUVER'S ISLAND, coal in, 3.
See also Canada.
Victoria, antimony in, 17, 21, 65; barks in, 254; barley in, 113, 115; beer in, 204, 229; boots and shoes in, 401; butter in, 94; cattle in, 89, 90; cheese in, 94; chemical industries of, 257; cigars in, 244; clay in, 17; coal in, 17, 21; copper in, 17, 21, 65; earth, infusorial, in, 65; fibres in, 371; flagging in, 21; fossils in, 66; fruit in, 131; gold in, 17, 21, 53, 63; gums in, 254, 284; hops in, 251; iron in, 20, 21, 65; iron, tungstate of, in, 65; kaolin in, 65; lead in, 20, 21, 64; leather in, 392, 398; lime, tungstate of, in, 65; machinery in, 484; maize in, 115; manganese in, 65; meat, preserved, in, 94; minerals, statistics of, in, 21; Mines, Department of, of, 21; oats in, 113, 115; oils in, 253, 284; oils (medicinal) in, 254; oils (for perfumes) in, 254; opium in, 250; pharmaceutical products of, 259; pigs in, 89; potatoes in, 115; resins in, 284; rock crystals in, 65; rock specimens of, 66; saddlery and harness in, 402, 403; sheep in, 89, 90, 94; silk in, 337; silkworms in, 338; silver in, 20, 21, 64; slate in, 21; soaps in, 277; spirits in, 223; stone in, 20; tallow in, 262; timbers in, 419, 466, 474; tin in, 20, 21, 53, 64; tobacco in, 244; vine cultivation in, 194; wheat in, 113, 114, 125, 126; wines in, 194, 211; wolfram in, 65; wools in, 316, 328; zinc in, 65.
See also Australia.
Vine Cultivation, methods of, 196, 201; vine diseases, 196, 200.
—— in Canada, 200; Cape of Good Hope, 199; Cyprus, 201; New South Wales, 193; South Australia, 194; Victoria, 194.
Vinegar, 231, 253.
Volcanic Specimens of Ascension, 80; Mauritius, 84; St. Helena, 84; Seychelles, 84.

WAGES in New South Wales, 112.
Walnuts in New Zealand, 133.
Wax, bees, 275; black, 295; candle, 255; Chinese, 274; myrtle, 275; sealing, 284.
—— in Australia, 252; British Guiana, 295; British North Borneo, 252, 275; Cape of Good Hope, 255, 276; New South Wales, 252, 284; Sierra Leone, 297; Western Australia, 252.
Weeds in Manitoba, 106; North-West Territories of Canada, 106.
West African Colonies, calabar beans in, 251; drugs (native) in, 257; gums in, 252.
See also Gambia, Gold Coast, Lagos *and* Sierra Leone.
West Indies, barks in, 251; cinnamon in, 251; fibres in, 380, 389; ginger in, 252; gums in, 252; hides in, 395; honey in, 253; lime-juice in, 253; oils in, 253; pepper in, 252; silk in, 355.
See also Jamaica *and* Trinidad.
Western Australia, beef, salt, from, 95; beer in, 205, 230; boots and shoes in, 402; cattle in, 89; chemical products of, 257; copper in, 31, 71; fibres in, 370; fossils in, 72; fruit in, 133; geology of, 32; goats in, 321; gold in, 31, 53, 71; gums in, 254, 286; honey in, 252; iron in, 32, 71; lead in, 32, 71; leather in, 399; lignite in, 71; maize in, 119; oats in, 119; oils in, 253, 263, 264, 273; pigs in, 89; resins in, 286; rock specimens of, 72; saddlery and harness in, 403; sarsaparilla in, 250, 254; satin in, 345; sheep in, 89, 90; silk in, 345; silkworms in, 345; spirits in, 223; stone in, 32; timbers in, 430, 468, 474; tobacco in, 237; vinegar in, 231; waxes in, 252; wheat in, 118; wines in, 199, 220; wools in, 321; zinc in, 71.
See also Australia.
Wheat in British Columbia, 110; Canada, 99; Cape of Good Hope, 123; Cyprus, 124; England, 126; India, 125, 126; Manitoba, 107, 108, 110; Natal, 123; New Brunswick, 101; New South Wales, 111; New Zealand, 119, 120,

122; North-West Territories of Canada, 107, 108, 110, 125, 126; Nova Scotia, 100; Ontario, 102; Prince Edward Island, 101; Queensland, 117, 118; South Australia, 115, 116, 125, 126; Victoria, 113, 114, 125, 126; Western Australia, 118.
Windmills, 483.
Windward Islands, *see* Barbados, Grenada, St. Lucia, St. Vincent *and* Tobago.
Wines, alcohol in, 199; Australia, first importation from, 193; fruit, in New Zealand, 206; nomenclature of, 193, 198, 200, 201; prizes for Australian, 195.
—— in Canada, 200, 222, 231; Cape of Good Hope, 199, 222; Cyprus, 201, 221; New South Wales, 193, 206; New Zealand, 199, 220; Queensland, 199, 219; South Australia, 194, 213; Victoria, 194, 211; Western Australia, 199, 220.
Wolfram in New South Wales, 62; Queensland, 69; Victoria, 65.
Woods, *see* Timbers.
Wools, classification of, 309, 311; "kemps" in, 328; quantity of, 306; statistics relating to, 314, 318, 320, 321, 323, 326, 327; structure of, 310, 328.
—— in Canada, 313; Cape of Good Hope, 323; India, 312; Natal, 326; New South Wales, 313, 328; New Zealand, 322; Queensland, 320; South Australia, 318, 328; Tasmania, 327; Victoria, 316, 328; Western Australia, 321.
Wynaad, coffee in, 168.

ZINC, tungstate of, in New South Wales, 62.
—— in Canada, 57; New South Wales, 61; New Zealand, 73; South Australia, 24, 67; Victoria, 65; Western Aus-Australia, 71.
Zircons in Ceylon, 82; New South Wales, 63.

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
STAMFORD STREET AND CHARING CROSS.

3 2044 102 821 972